DOUBLE NUMBER

VOL. XXXV OCTOBER, 1919 Nos. 1 & 2

JOURNAL

OF THE

Elisha Mitchell Scientific Society

CONTENTS

PROCEEDINGS OF THE EIGHTEENTH MEETING OF THE NORTH CAROLINA ACADEMY OF SCIENCE 1

NOTES ON OCCURRENCE OF *TINTINNUS SERRATUS* IN CHESAPEAKE BAY. *Bert Cunningham* 12

ON SOME GENERIC DISTINCTIONS IN SPONGES. *H. V. Wilson*.. 15

A PORTABLE PRINTING PRESS FOR THE ECOLOGIST. *Z. P. Metcalf* 20

CRATERELLUS, CANTHARELLUS, AND RELATED GENERA IN NORTH CAROLINA; WITH A KEY TO THE GENERA OF GILL FUNGI. *W. C. Coker* 24

JUGLONE. *Alvin S. Wheeler*..... 49

OUR RATS, MICE, AND SHREWS. *C. S. Brimley*..... 55

NOTES ON THE FLORA OF CHURCH'S ISLAND, NORTH CAROLINA. *W. L. McAtee* 61

THE DISTRIBUTION OF *RHODODENDRON CATAWBIENSE*, WITH REMARKS ON A NEW FORM. *W. C. Coker* 76

ISSUED QUARTERLY

CHAPEL HILL, N. C., U. S. A.

ENTERED AT THE POST OFFICE AS SECOND-CLASS MATTER

The Elisha Mitchell Scientific Society

W. C. COKER, President.

J. M. BELL, Vice-President.

A. W. HOBBS, Secretary and Treasurer.

F. P. VENABLE, Permanent Secretary.

EDITORS OF THE JOURNAL:

W. C. COKER.

COLLIER COBB.

J. M. BELL.

Journal of the Elisha Mitchell Scientific Society—Quarterly. Price $2.00 per year; single numbers, 50 cents. Most numbers of former volumes can be supplied. Direct all correspondence to the Permanent Secretary, at University of North Carolina, Chapel Hill, N. C.

On account of strikes in New York, Plate I, in colors, which was to face this page, has not been printed. The editors hope to include this plate under the same number in a following issue, so that it may be inserted here when the volume is bound.

JOURNAL

OF THE

Elisha Mitchell Scientific Society

Volume XXXV OCTOBER, 1919 Nos. 1 and 2

PROCEEDINGS OF THE EIGHTEENTH MEETING OF THE NORTH CAROLINA ACADEMY OF SCIENCE HELD AT TRINITY COLLEGE, DURHAM, N. C., MAY 2 AND 3, 1919.

The executive committee met at 12:00 M. on Friday with the following members present: President E. W. Gudger, Secretary Bert Cunningham, and Dr. J. J. Wolfe. Prof. Z. P. Metcalf was made a member *pro tem.* The Secretary made a report on the finances which appears at its proper place in the records. The report on membership showed that at present there are 91 members, 8 of whom are in the army. Four members have resigned. Fourteen new members were elected, and these are included in the above total. New members elected are as follows:

Andrews, W. H., Assistant in Geology, University of North Carolina.

Binford, Raymond, President of Guilford College.

Bynum, J. C., Instructor in Geology, University of North Carolina.

Davis, H. T., Assistant in Geology, University of North Carolina.

Edgerton, F. N., Jr., Assistant Professor of Engineering, Trinity College.

Hatley, C. C., Instructor in Physics, Trinity College.

Krausz, H. B., Farm Forestry Specialist, Raleigh, N. C.

Markham, Blackwell, Medical Student, University of North Carolina.

PETTY, MISS MARY, Professor of Chemistry, State College for Women.

RHODES, L. B., Chemist, Raleigh.

SAVILLE, THORNDIKE, Associate Professor of Sanitary Engineering, University of North Carolina.

SHAFFER, MISS BLANCHE E., Department Home Economics, State College for Women.

SHERRILL, MISS MARY L., Associate in Chemistry, State College for Women.

VANN, MISS FANNIE E., Instructor Mathematics, Durham City High School.

An invitation was extended and accepted to hold the next meeting of the Academy at Wake Forest.

The executive committee then adjourned.

At 2:30 p. m. President Gudger called the Academy to order and appointed the following committees: Auditing, Z. P. Metcalf, J. M. Bell, R. N. Wilson; Resolutions, Collier Cobb, Miss Mary Sherrill, R. W. Leiby; Nominating, H. V. Wilson, W. H. Pegram, C. S. Brimley.

The reading of papers was then begun and carried on until 5:30 p. m. The Academy reconvened at 8:00 p. m. and were welcomed to the college by President Few. This welcome was responded to by President Gudger on behalf of the Academy. The Presidential address was then given (see abstract below). At 9:30 p. m. the Academy adjourned to the Faculty Club Room and became the guests of the Faculty of Trinity College at a "get acquainted gathering" called a Reception.

The Academy was called to order by the President at 9:00 a. m. Saturday for the business session. The minutes of the last meeting were read and approved. The Treasurer made his report which is appended hereto. This had been audited and ordered printed.

The nominating committee reported and the following officers were elected for the ensuing year:

President—A. H. Patterson, Professor of Physics, University of North Carolina.

Vice-President—R. N. Wilson, Professor of Chemistry, Trinity College.

Secretary-Treasurer—R. W. Leiby, Entomologist, Raleigh.

Executive Committee (additional members)—Z. P. Metcalf, H. B. Arbuckle, Miss Mary Sherrill.

The Resolutions Committee reported, as follows:

Resolved, That we, the members of the North Carolina Academy of Science, express to the President and Faculty of Trinity College our hearty appreciation of their hospitality, extended to us on the occasion of the eighteenth annual meeting of the Academy. Nothing could have been more delightful than their arrangement for our social intercourse which has been stressed here even more than at former meetings.

The Committee on High School Science reported that no meeting had been held. This committee was reconstituted, by action of the Academy, with Dr. E. W. Gudger as chairman, the other members being the same, and continued. There was considerable discussion over the question.

It was moved and carried that all members in the army should be continued without the payment of dues for this year.

At 10:30 the joint meeting of the Chemists and Academy was held.

At 11:30 the Chemists withdrew for their special meeting, and the Academy proceeded with the papers. Adjournment for dinner was had at 1:00 p. m. and the Academy reconvened at 2:00 and proceeded with papers until 4:30. After this Mr. G. A. Rhea demonstrated a motion picture machine, using a nitrogen lamp and a noncombustible film. The Academy then adjourned *sine die*.

REPORT OF BERT CUNNINGHAM, TREASURER, 1918–1919

RECEIPTS

Dr. E. W. Gudger, Treas.	$ 138.97
Dues	68.00
Savings acct. interest	1.30
Total receipts	$ 208.27
Less expenditures	13.10
Balance	$ 195.17

RESOURCES

Saving acct.	$ 131.30
Checking acct.	63.22
Cash on hand	.65
	$ 195.17

OTHER RESOURCES ESTIMATED

Due from chemists	$ 2.50
Stamps on hand (about)	.50
Dues unpaid (about)	28.00
Estimated resources	$ 226.17
Less outstanding bills	82.00
Estimated balance	$ 144.17

EXPENDITURES

Stamps	$ 5.00
Notices	2.00
Stationery	4.75
Clerical services	1.00
Express	.35
	$ 13.10

DEBTS OUTSTANDING

Journal	$ 75.00
Programs	6.00
Secretary's fee	1.00
	$ 82.00

Following is the present membership. Those present at the meeting are starred, those in the army are marked (*a*):

Arbuckle, H. B.....Davidson
*Andrews, W. H.....Chapel Hill
Bahnson, F. F.....Winston-Salem
Beardslee, H. C.....Asheville
*Bell, J. M.....Chapel Hill
Binford, Raymond.....Guilford College
*Bivins, Mrs. F. C.....Durham
Bonney, Miss E. C.....Hartsville, S. C.
Bottum, Miss F. R.....Raleigh
*Brimley, C. S.....Raleigh
*Brimley, H. H.....Raleigh
Bruner, S. C.....Santiago de las Vegas, Cuba
*Bynum, J. C.....Chapel Hill
Cain, Wm. .....Chapel Hill
Clapp, S. C.....Swannanoa

*Cobb, Collier.....Chapel Hill
Cobb, Wm. B.....Bureau of Soils, Washington, D. C.
*Coker, W. C.....Chapel Hill
Collett, R. W.....Raleigh
*Cunningham, Bert.....Care Dept. Zool, Madison, Wis.
*Davis, H. T.....Chapel Hill
Detjen, L. R.....West Raleigh
Downing, J. S.....Elsmere, Delaware
aDixon, L. F.....———
aDobbins, C. N.....———
*Edwards, C. W.....Durham
*Egerton, F. N., Jr.....Durham
Farmer, C. M.....Lynchburg, Va.
aField, R. H.....———
*Gudger, E. W.....Greensboro
*Hatley, C. C.....Durham
Hewlett, C. W.....Greensboro
Hickerson, T. F.....Chapel Hill
aHoffman, S. W.....———
*Holmes, J. S.....Chapel Hill
aJohnson, E. D.....———
Kilgore, B. W.....Raleigh
Kraüsz, H. B.....Raleigh
Lake, J. L.....Wake Forest
Lanneau, J. F.....Wake Forest
*Leiby, R. W.....Raleigh
Lewis, R. H.....Raleigh
Marion, S. J.....Raleigh
*Markham, Blackwell .....Chapel Hill
Mendenhall, Miss Gertrude W.....Greensboro
*Metcalf, Z. P.....West Raleigh
Nowell, J. W.....Wake Forest
Patterson, A. H.....Chapel Hill
*Pegram, W. H.....Durham
*Petty, Miss Mary.....Greensboro
Poteat, W. L.....Wake Forest
aPratt, J. H.....Chapel Hill
Rankin, W. S.....Raleigh
*Rhodes, L. B.....Raleigh
Riddick, W. C.....West Raleigh
Robinson, Miss Mary.....Greensboro
*Saville, Thorndyke .....Chapel Hill
Sherman, Franklin, Jr.....Raleigh
Seymore, Miss Mary F.....Raleigh
*Shaffer, Miss Blanche E.....Greensboro
Shore, C. H.....Raleigh

*Sherrill, Miss Mary L.....Greensboro
Strong, Miss Cora.....Greensboro
aStiles, C W.....———
Smith, J. E.....Ames, Iowa
aTotten, H. R.....Chapel Hill
*Vann, Miss Fannie E.....Durham
*Venable, F. P.....Chapel Hill
*Wheeler, A. S.....Chapel Hill
*Wilson, H. V.....Chapel Hill
Williams, L. F.....Raleigh
*Wilson, R. N.....Durham
Withers, W. A.....West Raleigh
Wolf, F. A.....West Raleigh
*Wolfe, J. J.....Durham

The following papers were then presented:

On the Use of the Sucking-Fish, Echeneis or Remora, For Catching Fish and Turtles. (Presidential Address) E. W. GUDGER.

This paper gave a careful review of all the published accounts of this use of this interesting fish. The first European who ever beheld this curious method of fishing was Christopher Columbus on his second voyage, May 19, 1494, on the south side of Cuba. The first printed account came from the press of Albertino Vercelles da Lisona at Venice on April 10, 1505, and this account is repeated with variations by all the Spanish chroniclers of the early explorations in the West Indies.

It has long been so used in the Mozambique country and in Madagascar. The literature contains at least five references. The earliest printed one dates back to Dampier in 1729, but there is a native Malagassy manuscript, which gives an account probably long antedating the printed accounts.

It is known to be practiced at the present time by the Chinese fishermen of Singapore, but the greatest wealth of references is to the use of this fish for taking turtles by the aborigines of Torres Straits, between Australia and New Guinea. To its use here no fewer than ten separate writers testify, some of these eye-witnesses.

Experiments made in the New York Aquarium lead to the conclusion that such use is possible. Calculations as to the adhesive power of the disk show that the adhesion is ample to effect the cap-

ture of such prey as it is used to take. Lastly data adduced show that the fish can endure the strain necessary to the "playing" and pulling in of the fish or turtle.

The paper was illustrated by all the known figures showing this use of this fish. The completed paper will be published shortly.

Reproduction In Cyclops. FANNIE E. VANN.

Several experiments were carried on in rain water, filtered pond water, distilled water, and sterile pond water as media which were free from unattached eggs and larvæ, during the months of April, May, December, 1918, January, February, March, April and May, 1919. Some of the experiments were run in glass standers, and others in egg shells as containers. Our conclusions were: (1) Egg production and hatching occur the year round (with summer results to be determined); (2) mature individuals producing eggs are produced from March, April, and May hatched larvæ; (3) the best culture medium is filtered pond water; and (4) that the best container is a membraneous vessel placed in a bowl of "native" water. Illustrated by lantern.

Deposits of Volcanic Ash. JOHN E. SMITH.

(Read by Title)

In the United States these deposits may be divided into three groups: (1) surface deposits, those at or near the surface which enter into the composition of the soil; (2) bedded deposits, at some depth used chiefly as a source of abrasive material for scouring soaps and polishing powders; and (3) indurated deposits, tuffs now weathering to soil as in the southern Piedmont belt.

Deposits of volcanic ash occur abundantly in the Rocky Mountain region and westward. In Texas, the deposits extend eastward to an area only a few counties distant from the Gulf. In Oklahoma, they reach nearly to the Arkansas boundary; in Missouri, glass, doubtless of this origin, has been identified in the soil; and in Nebraska, volcanic ash is reported to be present in nearly every county in the state. It is found also in South Dakota and Montana. Thruout the Plains region in some of the deposits, ash is mixed with stratified clay which is evidence that it fell into water. This water was certainly fresh in western Nebraska and probably elsewhere.

The eruptions of Mt. Katmai, Alaska, in 1912, of Krakatoa, Sunda Islands, in 1883 and of various other mountains have proved that volcanic ash is sometimes deposited in beds of considerable thickness a hundred miles or more from its source. In the Great Plains region of the United States, the deposits of this material are thicker and its texture coarser toward the west and thinner and finer respectively toward the east which indicates an origin in the region of the Rocky Mountains. In age they range from the Oligocene to the Pleistocene and later.

Examples of indurated tuffs occur in Michigan, Massachusetts and North Carolina among the Pre-Cambrian rocks labeled in museums with such names as petrosilex, hornfels and novaculite and also among those called flint-like slates and silicified tuffs by some writers.

Recent Mosquito Control Work in North Carolina. R. W. LEIBY.

Brief outline of diseases known to be transmitted by mosquitoes, with emphasis upon those occurring in North Carolina. Resumé of control work done in North Carolina with account of antimalarial operations at Wilmington, N. C. Illustrated with lantern slides and motion pictures.

Some Notes On Protozoa. BERT CUNNINGHAM.

(*a*) The occurrence of *Tintinnus serratus* Kofoid, in Chesapeake Bay, is printed in full elsewhere in this JOURNAL. *(b) Arcella excavata,* nov. sp., most nearly resembles *A. curvata* Wailes, but is characteristically different. Illustrated by lantern.

The Ovary of the Gaff-Topsail Catfish, Felichthys felis. E. W. GUDGER.

This organ is composed of two sacs separate in front but united posteriorly to form a common oviduct opening on the genital papilla. The walls of the posterior or oviducal third lie in parallel ridges to allow for the distention necessary in the passage of the great eggs averaging 20 mm. in diameter. These ridges decrease in height

anteriorly and in the middle third of the organ become covered with small eggs which never become functional. The anterior third of each ovisac is the functional ovary and its walls are lined with huge eggs each in its follicular sac attached to the wall of the ovary by a long pedicel.

This paper, which was illustrated by drawings and photographs, will shortly be published by the Carnegie Institution of Washington.

A Parasitic Blue-Green Alga. W. C. COKER.

In April of last year we collected in a ditch at the Golf Links near Wilmington, N. C., a species of Saprolegnia that I am treating as a form of *S. anisospora* DeBary. Cultures made in the ditch water with Alga, etc., in which the species was taken showed a remarkable abnormality. A good many of the oogonia were much swollen to as much as twice the average size, while the eggs, which were no greater in number than usual, were in great part disorganized, often only one or two maturing. The disorganized eggs would usually reach the point of forming a thin wall, and would then go to pieces inside. This condition was not thoroughly realized until after the culture had been purified on agar and the abnormality thus arrested. It was then found from slides that the enlarged oogonia contained a parasitic organism with the exact appearance of a blue-green alga, which ran among the eggs. There was not the least resemblance to the ordinary fungal parasites that attack the Saprolegnias, and it is to be regretted that the parasite was lost before it could be more thoroughly studied.

Investigations of the Nitrotoluenes. JAMES M. BELL.

The four principal products of nitration of toluene are o-nitrotoluene, p-nitrotoluene, 1-2-4 dinitrotoluene and 1-2-4-6 trinitrotoluene. All of these are of interest in the manufacture of explosives and of dyes. As the analysis of mixtures of these by ordinary chemical methods is impossible, indirect methods of analysis only can give the composition of such mixtures. A method of finding compositions of binary mixtures and of ternary mixtures of the last three nitro-

toluenes mentioned above was obtained by studying their melting points and by mapping the results by means of triangular coördinates. The results will be printed in full in a later number of the Journal.

New Naphthalene Dyes. A. S. WHEELER.

Juglone is a compound known for over fifty years to be present in walnut hulls. These hulls as well as other parts of the walnut tree may be used to produce a rich brown dye and have long been so used by the farmer's wife. The exact character of the dye is not known, but most likely is a near derivative of juglone. The latter compound may be synthesized from naphthalene. Another name for it is 5-hydroxynaphthoquinone. The halogen derivatives of such compounds have been very little studied. If juglone is chlorinated or brominated in the cold unstable addition products are obtained, but these are readily converted by the action of alcohol into stable monosubstitution products. If juglone is chlorinated or brominated in hot solution stable higher halogenated substitution products are obtained. All of the stable products act as dyes since they contain a chromophore as well as an auxochrome group. Owing to the presence of the phenolic hydroxyl group they form easily soluble sodium salts, practical for purposes of dying. The tribromojuglone imparts a champagne color to silk, a tan color to wool and this may be changed to various tints by the use of mordants. Cotton is not affected unless mordanted with tannic acid. Dichlorojuglone gives a rich bronze color to silk and the hydroxydibromo-juglone a delicate lavender which is markedly changed by mordants. Other dyes are being prepared in this field and a patent to cover all has been applied for.

The following papers appear elsewhere in this issue of this Journal.

A Portable Printing Press for the Ecologist. Z. P. METCALF.
Some Generic Distinctions in Sponges. H. V. WILSON.
Our Rats, Mice, and Shrews. C. S. BRIMLEY.
Reptilian Folklore. C. S. BRIMLEY.
The Distribution of Rhododendron Catawbiense, with Remarks on a New Form. W. C. COKER.

For the following papers no abstracts have been received:

Undamped Electrical Oscillations. C. W. EDWARDS.

Sanitation in the South. THORNDIKE SAVILLE.

A Magnetic Paradox. F. N. EGERTON, JR.

Vegetation in the Closing of Ponds with Special Reference to the Kamaplain Ponds of Wexford County, Michigan (Lantern). COLLIER COBB and H. D. HOUSE.

Asymmetry in the Formation of the Nervous System of the Frog Embryo. BLACKWELL MARKHAM.

New and Little Known Diatoms from Beaufort, North Carolina (Lantern). J. J. WOLFE.

The Seventeen-year Locust in North Carolina in 1919. Z. P. *Metcalf.*

The High Frequency Electric Furnace. F. N. EGERTON, JR.

The Felsites of Mount Collier. JOHN E. SMITH. (Read by Title.)

The Inland Waterway from Boston to Beaufort. COLLIER COBB.

Location of Invisible Objects. C. C. HATLEY.

BERT CUNNINGHAM, *Secretary.*

NOTES ON OCCURRENCE OF *TINTINNUS SERRATUS* IN CHESAPEAKE BAY

By Bert Cunningham

The genus Tintinnus was first named by Shrank. By Dujardin and Perty it is not considered good. It is held as good by Kent, Duc 'd Orleans, Pritchard, Claparede and Lachman.

The species *serratus* was named by Kofoid[1] in 1905, the individuals being taken "inside the kelp belt off San Diego in June."

The writer has found this species in the Plankton Collections taken by the United States Bureau of Fisheries in Chesapeake Bay during the years 1915–1916.

The similarity of form may be seen from the following comparisons (Table 1):

TABLE 1.

	Pacific Form	Atlantic Form
Length.....	150μ	150μ
Diameter A.....	18μ	18μ
Oral Ap. Dia....	25μ	20-22μ
Diameter P.....	15μ	15μ
Teeth.....	20	about 20

Kofoid gives the number of teeth as 20. In the material examined by the writer the number was estimated as 20, before access was had to the Kofoid's paper.

The collections of the Bureau were made more or less throughout the year and the following tables are taken from the data which is involved in the report of the Plankton investigation.[2]

[1]Kofoid C. A. Some New Tintinnidæ from the Plankton of the San Diego Region, Univ. of Cal. Pub. Vol. 1, No. 9. July, 1905.

[2]The report of this plankton work has not yet been published.

The yearly occurrence is shown in the following Table:

TABLE 2.

Area	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	C	N	C	C	N	C	40	N	600	C	N	N
F	C	N	40	C	N	C	C	N	200	N	N	N
J	C	N	C	C	N	40	120	N	200	C	N	C
L	N	N	C	C	N	N	40	N	N	N	N	C
M	C	N	C	N	N	C	C	N	80	C	N	C
P	N	N	C	C	N	N	40	N	C	40	N	C
R	C	N	N	N	N	C	80	N	N	C	N	C
X	C	N	C	C	N	40	C	N	120	N	N	C

Explanation of Table 2.

c—collection taken but *T. serratus* not found.
n—no collection taken.
The numbers indicate the individuals per liter, based upon the counting of .25 cc. of sea water. Areas indicate definite locations.

The occurrence is always on the surface except in one case, where it occurred in 9 meters of water and only one individual was found in 25 cc. of sea water.

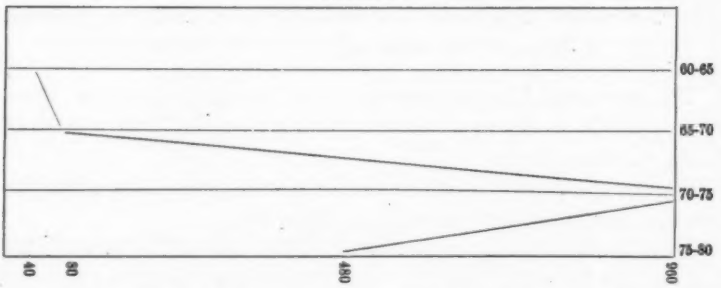
Though the organism occurs also in March, June, July and October, the maximum occurrence is in September.

A study of the temperature relations shows that while the organism has a range from 38.7° to 78.5° that the optimum lies from 70°–75°. The temperature data is tabulated in Table 3 and a graph is shown in Table 4.

TABLE 3.

AREA	Col. No.	Date	Temp.	Organisms
A	8509	July 26	75.8	40
	8682	Sept. 9	74.1	600
F	8461	Mar. 6	38.7	40
	8684	Sept. 12	72.5	160
J	8566	June 11	68.2	40
	8608	July 27	78.5	120
J	8671	Sept. 10	75.3	160
L	8615	July 28	78.2	40
M	8668	Sept. 10	74.8	80
P	8349	Oct. 25	63.5	40
P	8614	July 28	78.4	40
	8665	Sept. 10	74.5	0 (?)
R	8618	July 30	77.4	80
X	8584	June 12	66.5	40
X	8657	Sept. 9	75.0	120

TABLE 4.



The rareness of the occurrence may perhaps be better understood when we realize that the numbers in these tables indicate the calculated number per liter, while the number actually observed was 1/40 of this. It is further shown by a comparison of the number of these with the total number of organisms in the collection. The best ratio is 1:125, while the average is 1/350.

There is insufficient data concerning the tides to determine whether this is an ocean or bay form.

ON SOME GENERIC DISTINCTIONS IN SPONGES.

By H. V. Wilson

Genus Tetilla O. Schmidt 1868. Suborder Sigmatotetraxonida. Tribe Sigmatophora. Family Tetillidæ.

Tetilla O. Schmidt+Chrotella Sollas, Sollas 1888.

Tetilla O. Schm., Lendenfeld 1903.

Tethya Lamarck, *pars,* Lendenfeld 1906.

Typically the ectosome is not a distinct layer but shades off into the choanosome; the pores and oscula scattered, and not located in special depressions. In some species, however, the ectosome is to some extent histologically differentiated and partially assumes the character of a fibrous cortex, thus constituting an approach to Tethya. And in some species there are special depressions, on the smooth floor of which numerous small apertures (afferent pores or small oscula or both?) are located; these species in respect to this feature, ranging over towards Cinachyra. There is no special cortical skeleton. The microscleres have been lost in some species.

Lendenfeld, 1906, merges Tetilla in Tethya (Craniella *auct.*) and hence changes the family name to Tethydæ. As I have elsewhere said (George & Wilson, Sponges of Beaufort Harbor and vicinity), it seems best to retain both genera, and the family name (Tetillidæ) may be left unchanged.

Tetilla, the simplest and therefore presumably the ancestral genus of the family, has been gradually enlarged in the practice of recent writers by the incorporation in it of atypical species that depart in one direction or another from the central group of typical forms to which Sollas' definition(1888) is applicable. Thus species that have differentiated in the direction of Tethya, in that they have a fibrous cortex, are here included (*T.longipilis* Topsent 1904; *T.anomala* Dendy 1905; *T.borodensis* Dendy 1916). Other species are classed here that have differentiated toward Cinachyra in that there are superficial poriferous depressions, the floor of which exhibits pore-like apertures, the inhalent or exhalent nature of which seems not to be certain (cf.Kirkpatrick 1905, Dendy 1905), but these species lack the fibrous cortex and cortical skeleton of Cinachyra

(*T.hirsuta* Dendy 1889, 1905; *T.limicola* Dendy 1905; *T.cinachyroides* Hentschel 1911).

Tetilla and its relatives offer excellent illustrations of the fact that sponge genera become more and more difficult to distinguish as the number of known species increases, and I venture to set down some reflections on this matter.

Each genus is, of course, only a group that has been gradually built up round a type embodying a certain combination of well-marked features or "characters." In the cases of the related genera Tetilla, Tethya, and Cinachyra, the main "characters," grouped (Mendelwise) in pairs the members of which contrast, are as follows:

1. A non-fibrous cortex (*a*), or a fibrous cortex (*A*).
2. Radiating cortical spicules not present (*b*), or present (*B*).
3. Pores scattered (*c*), or grouped in poriferous depressions (*C*).

Of these characters Tetilla typically embodies *a, b,* and *c;* Tethya, *A, B,* and *c;* Cinachyra, *A, B,* and *C.*

Comparison of related sponge species indicates that the characters vary, more properly *have* varied during the evolution of the present races, independently of one another, and hence the number of combinations actually found increases with the number of species that come to be known in a genus. In the case of the above group of forms there are more combinations than there are recognized genera, and this is, of course, often the case in systematics. Thus among the species congregated under Tetilla, we find not only the typical combination but others as well: *A, b,* and *c; a, b,* and *C.*

In such a state of affairs we may either combine genera until we get groups so heterogeneous as to be useless to biology, or we can go on splitting up genera on the plan that each genus shall represent only a particular combination. Thus, on this idea, it would be logical to divide the species, now grouped under Tetilla, into three genera.

But another difficulty faces us here in that the extremes of a character, the sharply contrasting conditions that constitute the members of a pair, are so often connected by intergrades. Thus in Tetilla, between non-fibrous cortex and fibrous cortex there are many intergrades. And it may confidently be said that the more intensive

grows the study of a group of species, the more of these intergrading series come to be known. Hence it may be expected that the characters above designated as *b* and *B*, will, like *a* and *A*, be found to intergrade, and *c* and *C* likewise, if indeed the recorded data do not already justify that conclusion.

In view of the common existence of intergrades between the contrasting members of a pair of generic characters (*a* and *A*, e.g.), it becomes in the end impossible to split sponges, organisms in general probably, into genera, each set of which shall represent a particular combination of characters.

What practice remains then for the classifier, who knows that without systematics, biological data in general cannot be recorded with any certainty that they will be found again, and who therefore must classify, but who does not wish to set up a system of categories which can be precisely defined *only because they are artificial*, and into which while some organisms go nicely, others can be brought only after a character is pared down in thought, or extended in thought? One way out, and as I have indicated above, the way into which we have fallen in the case of Tetilla, is to recognize large heterogeneous genera (Tetilla, e.g.) and other smaller, more homogeneous, ones. I cannot see at present any better way. It is certainly a preferable method, i.e., one that enables biologists to find the recorded data more successfully, than that of building up genera, all of which overlap extensively.

This contrast between small homogeneous genera and large heterogeneous ones is, like the contrast between homogeneous and heterogeneous species, perfectly well recognized and widely used in botany and zoölogy. Nevertheless the underlying idea is, I believe, not always appreciated in its full significance, and in such cases artificially defined groups continue to be made, with the single difference that they are called sub-genera instead of genera.

Of course, the division of a heterogeneous genus into subgenera is a useful practical method, but if it be assumed that every actual concrete organism can be put in some one of the neatly defined subgenera, we will be led astray from accurate observation and recording, since in respect to the differential characters intermediates exist.

We must recognize that precisely defined subgenera are ideas each of which is actually represented by perhaps only a few forms. Many other forms cluster round such central types in such wise as to be intermediate between them, sometimes intermediate between two types in respect to one character, and between two others in respect to another character.

All this militates against the making of too many systematic groups, because in the end, if the characters of the concrete organism are to be really recorded as they are, whatever groups are made, some qualifying statements will usually have to be added to the designation of the organism as of such and such a genus or subgenus.

I am making no plea for looseness of identification, far from it. But, incidentally at least, this paper does make a plea against attempting to define too precisely the place in nature of an organism through continued formation of new genera, or division of genera into subgenera. At any rate, the subgenus when used should be thought of, not so much as *a subdivision* but rather as one of several types within the genus, *subgeneric types,* standards as it were. Certain organisms will be found practically to conform to some one of these standards. While an organism that deviates can be briefly described by stating its differences from some standard.

Finally it may be pointed out that the relation of series, composed of intergrading members (viz., species of Tetilla, e.g., with cortex ranging from fibrous to non-fibrous) to the current Mendelian theory of germinal units is plain. If we assume enough units, the theory is applicable. But in thus enlarging the number to suit these facts, the Mendelian units or genes come to be synonymous with what we call hereditary properties. I mean the subtle, minute powers, many of which may act in concert to produce a sensible effect, the kind of germinal property which at its first appearance in the evolution of a race or strain we call a small heritable variation, when for instance we speak of the gradual summation of variations. In this way the gene is removed from its somewhat isolated position in biological thinking, and made available even to the systematist, who in adopting it, however, must also adopt Semon's contention[1] that all variation

[1] Richard Semon. Das Problem der Vererbung "Erworbener Eigenschaften," 1912.

is at bottom discontinuous, in other words, that quantitative differences are to be looked on as summations of minute unit differences.

That the Mendelian gene, whether or no it have a material, discrete body and a location in the germ substance, may be thought of somewhat in this way, has been pointed out by several, H. S. Jennings[2] and F. B. Sumner[3] among others. Sumner's facts and thinking, in the paper referred to, are of especial interest to zoölogists dealing with the classification of natural races, who would like to knit up systematics more closely with the study of variation and heredity. A quotation shows how close my own standpoint is to his in respect to certain points. In speaking of some mouse races, he sums up: "It is quite plain that these 'subspecies' have diverged from one another in respect to characters which have varied quite independently. There is no single graded series for all the characters—," *loc. cit.*, p. 205.

My proposition as to the use of subgenera in the case of large, heterogeneous genera is in accordance with the practice which is pursued at times by some systematists. The master-student of sponges, F. E. Schulze, in a parallel case, though one dealing with subspecies, thus marks out the treatment which he proposes for a horny sponge, *Hircinia variabilis.* In the first place he combines six recorded species, and then goes on to say "The older specific names of Schmidt, like *dendroides, flavescens,* may be employed as varietal names for *certain conspicuous combinations of characters* which frequently occur in particular localities, but *which are by no means constant.* Thus we may speak of a *Hircinia variabilis dendroides,* a *Hircinia variabilis flavescens,* etc. *But when a specimen does not conform to one of these types, we will have to designate it simply as Hircinia variabilis."*[4] (Italics, except for names, mine.)

CHAPEL HILL, N. C.

[2] H. S. Jennings 1917. Observed Changes in Hereditary Characters in relation to Evolution. Journ. Wash. Acad. Sci., Vol. VII.
[3] F. B. Summer 1918. Continuous and Discontinuous Variations and their Inheritance in Peromyscus. Amer. Naturalist, 1918.
[4] F. E. Schulze 1879. Unters. ü. den Bau u. die Entw. d. Spongien VIII. Die Gattung Hircinia Nardo und Oligoceras n. g. Zeitschr. f. wiss. Zool. Bd. XXXIII, p. II.

A PORTABLE PRINTING PRESS FOR THE ECOLOGIST

By Z. P. Metcalf

The writer has long regretted the deficiency of the present methods of labeling insects on pins. Usually one of two or three systems is followed. Either the labels are lettered by hand, a laborious and expensive process or the labels are printed by the printer. In the latter case one of two systems is usually followed. Either a general locality label is printed such as N. C. for North Carolina or labels are prepared for various separate places. It is not my purpose here to enter into a discussion of the geographical limits that must be established for any given locality. Practically speaking any insect taken within a collecting radius of a given town may be said to have been collected in that town. With this in mind labels should be used only for localities that are large enough to be found in a standard atlas. In the mountains elevations are often of importance and the writer long ago adapted the practice of trying to label things on the basis of 500 foot zones. Much other data may well be added to labels of specimens such as the day of the month, the month of the year and even the year, although the latter is frequently unnecessary. Some divide the month into three parts, early, mid and late and label their specimens accordingly, doing away with the day of the month entirely. I have omitted all reference to that well known, but to my mind reprehensible, system of giving specimens a catalog number and recording the data in a catalog. Such specimens are sure to get separated from their catalog and then the hidden meaning of the catalog is sure to haunt some one all his days. Frequently I have received a rare or interesting specimen labeled only with a catalog number when I would have given almost anything to know the real history of the specimen.

With all of these points in mind I was very much interested in a small hand stamp for printing pin labels in the office of Mr. H. S. Barber of the United States National Museum. The chief points about Mr. Barber's outfit that interested me were that he used a small metal holder in which the type was locked by means of a set

screw, that he used the regular printer's metal type, and that he used regular printer's ink. The further thought presented itself that if this was a good thing to have in an office why wouldn't it be a good thing to have a portable outfit to be carried into the field. Then the thought occurred to me that this thing ought to be useful to the general ecologist as well as the entomologist and thus in this round about way I have arrived at my reason for presenting this matter here. To discuss the subject briefly it may be divided into two parts; (1) the apparatus (2) the method of procedure.

My apparatus consists of a font of type, a type box, a compositor's roll, a tube of printer's ink, a bottle of benzine, a glass plate or two, a pair of forceps, and a type holder. The font of type may be of any size desired. Since the entomologist is interested in getting as much into as small a space as possible I use a 4¼ point type which is about one-half the size of ordinary book type and is about as small as can be used with ease. The type box I use is made with small compartments which are just a little wider than the type is high. My box contains 104 compartments because I use capitals, small capitals, lower case letters and a number of other characters. The box is made as tight as possible so that the type cannot become mixed in carrying it about. The lid of the box is lined with two sheets of blotting paper. Ink in a tube is much more convenient than in any other form as it remains much fresher and is more easily worked in this way. The benzine is used in mixing the ink and in cleaning the type. The compositor's roll is used to mix the ink also. The forceps are used to handle the small type, but may be dispensed with when using larger type. The type holder is a small brass box with a width slightly less than type height and with one side entirely wanting and the lid held in place by means of four set screws and with another set screw at one end of the box to hold the type in place. The box may be of any size and should be high enough to hold as many lines of type as we desire to print at one time and it should be long enough to hold all the characters we think we will ever use and then a few more for emergency. My box is high enough to hold four lines of 4½ point type, about all one ever desires to put on a single pin label.

The method of using this apparatus is simplicity itself. The first step is setting the type. The type are selected one after another, starting with the top line and placing the characters in order in the bottom of the type box. It will be noticed that each character has a groove called the "nick" on one face of the type to distinguish the bottom of the character. If the characters are properly placed the nicks on all of the characters are towards the lid of the box and can be examined after each line is set to determine whether each character is in proper position or not. After all the characters are in proper position the lid is lightly fastened by means of the four set screws and a small block of wood with a true face is laid on the face of the type and they are brought into a flat surface by gently tapping with a hammer.

The next step is mixing the ink. The ink is squeezed from the tube onto a glass plate (old negatives are good). Benzine is added drop by drop and the two mixed together until the proper consistency is obtained. Getting just the proper consistency is apparently a matter of practice and experience. After the ink is properly mixed it is rolled up on the compositor's roll in the form of a thin film. The ink is taken from the roll by the type.

The last step is printing the label. For printing pin labels I like to have narrow strips of paper of just the proper width so that one label can be trimmed with each cut of the shears. Not every label printed by hand will be perfect but experience will soon teach the proper consistency of the ink, the amount of ink to be applied to the type, and the proper pressure to give the type on the paper. For printing by hand the paper should be placed on two or three sheets of blotting paper to counteract any unevenness in the face of the type.

Lastly for the advantages. A recent case in point will perhaps be better than anything else. Mr. R. C. McGregor recently sent me a lot of Homoptera from the Philippines collected as follows:

Culasi, Panay. May 24, May 30, June 15, July 15, July 24.
Tibiao, Panay. May 12, May 14. Manilla, August 26.

To have labeled all of these specimens by means of lettered labels would have been a very laborious process. To have had separate

labels printed for each locality would have been unnecessarily expensive. To print these labels by hand and place them on the 300 or more specimens was the work of about one-half hour all told. Certainly nothing very laborious or troublesome. An outfit such as I have described can be carried to any field station and any and all special labels printed neatly and rapidly.

CRATERELLUS, CANTHARELLUS AND RELATED GENERA IN NORTH CAROLINA; WITH A KEY TO THE GENERA OF GILL FUNGI*

By W. C. Coker

Key to the Genera of Agaricaceæ or Gill Fungi

A. Spores white or yellowish (except in forms of *Pleurotus sapidus* where they are lilac, in certain species of *Craterellus* and *Cantharellus* and *Tricholoma* where they are pinkish, and in *Lepiota Morgani* where they are greenish 1

1. Plants fleshy, soft, usually soon decaying; if dried not reviving well when moistened. (Some of the smaller species of *Collybia* approach very closely to *Marasmius* in texture and revive when moistened) 2

1. Plants leathery and toughish, pliable; if somewhat fleshy, then reviving and assuming their original shape when moistened after drying 16

1. Plant corky or woody, firm, laterally sessile on wood (shelving); cap hairy, concentrically zonate (placed under the *Polyporaceæ*, which are to be treated later) ..... *Lenzites*

2. Plant growing on decaying mushrooms (*Russula*); gills thick with broad, blunt margins, or not rarely aborted ..... *Nyctalis*

2. Plant growing on decaying leaves of rhododendron, very minute (less than 1 cm. high and 1 mm. broad), gills aborted or few and distant, hymenium dissolving ..... *Eomycenella*

2. Plant not as above (if growing on other mushrooms the gills are not as in Nyctalis) 3

3. Spore-bearing surface (hymenium) smooth or obscurely veined towards the margin of the cap; plant funnel-shaped or with a spreading cap (in *C. Cantharellus* the spore surface is intermediate between this and the next genus) ..... *Craterellus*

3. Hymenium composed of more or less gill-like plates or veins, but their margins blunt and anastomosing or branching; spores buff or ochraceous or pinkish ..... *Cantharellus*

3. Hymenium composed of distinct gills, which are not fold-like or vein-like. (If the gills are thick with rather blunt margins, as in species of *Laccaria* and *Hygrophorus*, they do not anastomose freely and the spores are white) 4

4. Plants exuding a milky or colored juice when broken; flesh of cap composed in large part of globular cells and usually rather fragile. (The steam of some species of *Mycena* exudes a watery or colored juice, but the flesh is not composed of globular cells, and the plants are small and slender) ..... *Lactarius*

---

*The colored plate was painted by my niece, Dorothy Coker. The spore plate was mostly drawn by Miss Alma Holland. The photographs are by me and except where indicated are natural size as is also the colored plate.

4. Plants not exuding a juice (except from the stems of certain species of *Mycena*) 5
5. Plants usually quite brittle, the flesh composed of globular cells; spores white, creamy or yellowish, mostly spherical and marked with spicules, warts, or ridges (rarely smooth) ..... *Russula*
5. Plants not as above in all respects 6
6. Gills waxy and semi-translucent in appearance, usually thick and broadening towards the cap, the entire plant soft and usually fragile (The gills of *Laccaria* approach these in appearance, but the plants are tougher and less brittle) ..... *Hygrophorus*
6. Gills not as above, or if nearly so then the plant tough and firm 7
7. Stem none, or, if present, not in the center of the cap (rare exceptions); plants mostly growing on wood ..... *Pleurotus*
7. Stem central or nearly so 8
8. Stem easily separating from the cap, both stem and cap fleshy; gills free or nearly so 9
8. Stem continuous with the cap, not easily separating 10
9. Stem at base furnished with the remains of a volva, such as a cup or rings or warts or scales or meal (in a few species where these are regularly or at times absent the stem is distinctly bulbous); veil present and usually forming a ring on the stem; gills free or nearly so ..... *Amanita*
9. Stem and gills as above, but veil (and ring) absent ..... *Amanitopsis*
9. Veil present and gills free or nearly so, but stem without remains of a volva ..... *Lepiota*
10. Stem fleshy or fibrous and elastic, of the same texture as the cap 11
10. Stem cartilaginous, of a different texture from the cap 14
11. Stem with a veil (and ring); volva wanting; plants densely clustered and growing from stumps or roots ..... *Armillaria*
11. Stem without a veil or volva 12
12. Gills notched at the stem, i. e., attached but not by their whole width, and not decurrent 13
12. Gills decurrent, not sinuate (in a few species the gills are usually not decurrent, and they are sometimes various in this respect in the same plant, as in *C. tumulosa*. In *C. dealbata* they are squarely adnate or even a little notched at the stem as in *Tricholoma*, and in *C. nebularis* they are usually squarely attached) ..... *Clitocybe*
13. Gills thick with blunt edges, purplish or pinkish at all ages, but becoming conspicuously dusted by the white spores; stem toughish and fibrous ..... *Laccaria*
13. Gills thin, variously colored (if pinkish then turning color when bruised or in age); stem fleshy ..... *Tricholoma*
14. Gills decurrent ..... *Omphalia*
14. Gills not decurrent, or barely so 15
15. Margin of cap inrolled when young ..... *Collybia*
15. Margin not inrolled when young, plants small ..... *Mycena*

16. Gills split along the edge into two plates which roll outward when dry; plant sessile on wood.....*Schizophyllum*
16. Gills not as above.....17
17. Stem easily separating from the cap, central; cap toughish-leathery, thin, reviving to its original shape when moistened after drying, usually small and growing on wood.....*Marasmius*
17. Stem continuous with the cap or none, not separating easily, all growing on wood.....18
18. Gills blunt on the margin, fold-like and irregular; plants small, reviving when moistened, small, laterally sessile or hanging.....*Trogia*
18. Gills not as above.....19
19. Gills toothed on the edge.....*Lentinus*
19. Gills not toothed on the edge.....*Panus*

B. Spores rosy pink or salmon, or flesh color, or brownish pink or ochraceous pink or pinkish brick-color, or chestnut; and in most species the spores are irregularly angular or warted. In some (as *Claudopus variabilis*) the spore color is exactly intermediate between the typical pinkish color of this section and the ochraceous color of the next. The presence of any pink tint will indicate this group. Veil absent; a volva present only in *Volvaria*.

1. Stem lateral or none; growing on wood.....*Claudopus*
1. Stem central 2
2. Stem readily separating from the cap; gills free..... 3
2. Stem and cap of the same texture and not separating without tearing up; gills attached or almost free..... 4
3. Stem with a cup-like volva at the base.....*Volvaria*
3. Stem without a volva.....*Pluteus*
4. Gills sinuate (notched at stem) or almost free, or squarely attached and with a slightly decurrent tooth in some cases (distinctly decurrent only in *Leptonia formosa* var.)..... 5
4. Gills decurrent 7
5. Stem fleshy to fibrous.....*Entoloma*
5. Stem with the texture of cartilage..... 6
6. Margin incurved when young.....*Leptonia*
6. Margin straight even when young.....*Nolanea*
7. Stem fleshy to fibrous.....*Clitopilus*
7. Stem with the texture of cartilage.....*Eccilia*

C. Spores ochraceous, or rust color, or rusty-brown or dingy vinaceous-brown; the gills more or less similarly colored at maturity. (Certain species of Russula, a genus placed in the white spored group, have decidedly ochraceous or yellow spores, but these may be distinguished by the fragile-brittle texture due to the globular cells that make up the flesh of the cap.)

1. Gills usually separating with ease from the cap, veined between, usually anastomosing or forking; cap margin always inrolled .....*Paxillus*

1. Gills not as above; veil absent.....*Plicaturella*
1. Gills not as above; veil present..... 2
2. Veil composed of cob-web hairs (arachnoid), often invisible in age .....*Cortinarius*
2. Veil not cobwebby..... 3
3. Stem eccentric or none.....*Crepidotus*
3. Stem central 4
4. Stem with a ring.....*Pholiota*
4. Stem without a ring..... 5
5. Gills dissolving into a jelly or powder.....*Bolbitius*
5. Gills not as above..... 6
6. Gills free from the stem.....*Pluteolus*
6. Gills attached to the stem (adnate or adnexed)..... 7
7. Stem fleshy 8
7. Stem cartilaginous 10
8. Gills usually notched at the stem (sinuate)..... 9
8. Gills squarely attached (adnate) or decurrent.....*Flammula*
9. Cap scaly or fibrous or silky*.....*Inocybe*
9. Cap smooth, viscid.....*Hebeloma*
10. Gills decurrent .....*Tuleoria*
[not represented]
10. Gills not decurrent.....11
11. Cap margin inrolled when young at least.....*Naucoria*
11. Cap margin straight even when young.....*Galerula*

D. Spores dark-brown or brown with a tint of purple or deep smoky purple (nearly black); usually umber-brown (sepia) or purple-brown in purplish chestnut.

1. Stem easily separating from the cap; ring present.....*Agaricus*
1. Stem not easily separating from the cap..... 2
2. Veil present; ring present or wanting..... 3
2. Veil wanting 4
3. Stem with a distinct ring.....*Stropharia*
3. Stem usually without a ring; the veil hanging in tatters from the cap margin or disappearing early. (In *H. lachrymabundum* a ring is often present).....*Hypholoma*
4. Stem toughish-cartilaginous, hollow; margin of cap incurved when young .....*Psilocybe*
4. Stem as above or more fragile, hollow; margin of cap straight when young .....*Psathrya*

E. Spores black or nearly so, not purplish (deep smoky olive in *Gomphidius vinicola;* and in a few species of *Corprinus* they are deep brown, as in *Agaricus*, when fresh and moist, but turn almost black on drying).

*In a few species of Inocybe that are nearly smooth, such as *I. fallax*, the warty spores will distinguish them from Hebeloma.

1. Gills and margin of cap usually resolving into an inky fluid; if not, then the cap very thin and splitting or curling backwards ..... *Coprinus*
1. Gills or cap not as above 2
2. Ring present ..... *Anelaria*
2. Ring absent 3
3. Gills distinctly decurrent ..... *Gomphidius*
3. Gills not decurrent 4
4. Cap membranous, its margin distinctly striate, at least when moist ..... *Psathyrella*
4. Cap somewhat fleshy; margin not distinctly furrowed .... *Panæolus*

EOMYCENELLA

This genus has been proposed by Dr. Atkinson to contain a wonderfully delicate little plant found by him at Blowing Rock, N. C. His description follows: Atkinson (Bot. Gaz. **34**: 37. 1902).

"Plants stipitate. Pileus companulate to expanded, consisting of a layer of radiating branched threads forming a more or less lattice-like or trabecular, expanded, thin structure; trama wanting or very rudimentary the subhymenium arising directly from the trabeculæ of the pileus. Hymenium plane, or in larger forms with a few short, narrow, distant lamellæ not reaching the stipe; lamellæ with rudimentary trama. Basidia clavate, 4-spored. Spores smooth, 1-celled, hyaline. Stipe fleshy, delicate. At maturity hymenium dissolving, leaving many of the spores lying on an amorphous layer against the trabeculæ.

One species, on decaying leaves of *Rhododendron maximum,* Blowing Rock, N. C."

Eomycenella Echinocephala Atk.

This minute plant is included here because it is known only from North Carolina and because of its scientific interest to the student of mycology. The following description is also by Dr. Atkinson.

"Plants white, 3-8 mm. high. Pileus 0.5-0.75 mm. broad. Stipe 60-80μ in diameter. Plants campanulate to expanded and upturned in age, trabeculæ of upper surface echinulate, bearing here and there globose free branches, 10-15μ in diameter and also echinlate, margin of pileus with free clavate branches in the form of a fringe. Cells of the trabeculæ 25-30 x 6-10μ. Hymenium plane or with few short, narrow gills. Gills when present narrowed at each end, not reaching

the stipe. In the plant observed, 8 to 10 long lamellæ, 4 to 6 intermediate ones much shorter. Subhymenium loosely branched, obovate cells arising from the trabeculæ and terminating in the basidia, or in the forms with lamellæ arising from a rudimentary trama in the lamella. Basidia short clavate, abruptly narrowed into a pedicel, 9-12 x 6-9μ, 4-spored. Spores obovate-oblong, elliptical, proximal end pointed, 6-8 x 3-4 *u*, hyaline, smooth, granular. Stipe thread-like, with scattered hairs bearing a short echinulate cell on the end. Base of stipe only slightly broadened.

Eomycenella is related to Discocyphella[2] P. Hennings, but differs in the dissolving hymenium and the fact that the pileus is not gelatinous nor the stem horny. From Cymetella[3] Patouillard (placed with Agaricaceæ) it differs in the trabecular pileus and the dissolving hymenium; and from Glœocephala[4] (Clarvariaceæ) Massee, which has one-spored basidia. The latter should be placed in the Thelephoraceæ."

TROGIA

Plants small, growing on wood, laterally sessile, tough, persistent, reviving when wet; margin regularly lobed; gills fold-like; spores white.

We have but one species which we insert from records by Schweinitz and Curtis, as we have not found it.

Trogia crispa Fr.

The following is from Murrill (N. Am. Flora, **9**: 164. 1910 (as Plicatura):

"Pilei crowded, subimbricate, usually sessile, persisting, reviving when moistened, 1-2 cm. broad; surface reddish-yellow or tan, paler toward the margin, often whitish-villose when young; margin beautifully lobed: context fleshy membranaceous, tough, thin, white; lamellæ white, narrow, vein-like, irregular, continuous or interrupted, sometimes branched, edges crisped, obtuse, white or bluish gray: spores cylindric, smooth, hyaline, 4 x 1μ:"

Rare on alder twigs, etc. Schw. (Syn. Car. No. 837.)
Middle and upper districts, dead wood and sticks (as *Cantharellus crispus*). Curtis.

[2]Engler and Prantl, Pflanzenfamilien I: 554.
[3]Ibid. p. 555.
[4]Ibid. p. 131.

NYCTALIS

Plants growing on other mushrooms; small; cap mealy from the conidiospores; gills thick with blunt margins, or often fold-like or even aborted; veil not noticeable.

We have but one species.

Nyctalis asterophora Fr.

PLATES 2, 3 AND 16.

This remarkable plant is found occasionally growing in clusters on decaying plants of *Russula nigricans*. The caps are almost hemispheric and remain so at all ages, the margin strongly inrolled. They are up to about 3.8 cm. wide, white at first then grayish-buff and finally nearly buff, the surface tomentose-looking and soon becoming mealy from the loose coating of conidiospores that cover it.

Stem about 3-6 cm. long, and up to 6 mm. thick at top, tapering downward, white at first, then changing color more or less like the cap; usually crooked and irregular.

Gills very often aborted, when present they are thick, distant and narrow, with a blunt margin. Spores from the gills have been recorded, but usually seem to be suppressed, the reproduction depending on the conidiospores from the cap surface. These last are quite irregular in shape and size, usually longer than broad, more or less thickly covered with warty nodules, size about 14-19 x 18-26μ counting the warts. These conidiospores have been shown by Brefeld to be capable of reproducing the plant.

Illustrations: Mycologia 6: Pl. 129. 1914.
Kauffman Agar. of Mich. 2: Pl. 1. 1918.

1789. On a rotting *Russula nigricans*, pine grove at top of Lone Pine Hill, September 12, 1915. Photo and drawing of conidiospores.

2366. On rotting mushroom near Meeting of the Waters branch, by middle path, July 5, 1916. Photo.

2383. On dying *Russula nigricans*, base of Lone Pine Hill, June 28, 1916.

Asheville. Beardslee.
Middle and upper districts, on rotten agarics. Curtis.

NYCTALIS ASTEROPHORA, No. 2366

PLATE 3

NYCTALIS ASTEROPHORA ON RUSSULA NIGRICANS. No. 1789

CRATERELLUS

Plants upright, fleshy, funnel shaped or rarely fan shaped, hymenium on outside, smooth or more often rugosely wrinkled at least towards the margin. The genus is to all appearances so closely related to *Cantharellus* that I do not think that we are justified in placing one genus in the *Thelophoraceæ* and the other in the *Agaricaceæ* as is practiced at present. So close is the relationship in fact that it is doubtful if the two genera can be logically separated. Some species, as the one I have treated here as *Cantharellus clavatus,* are so intermediate as to be placed in *Cantharellus* by some authors and in *Craterellus* by others. *Craterellus cantharellus* has not only the same shape and general appearance of *Cantharellus cibarius,* but also the same fragrance; while the spores of *Cantharellus aurantiacus* and *C. cinnabarinus* are pink like the spores of *Craterellus cantharellus.* If the folds of the hymenium are more or less distinct gills the species should be looked for in *Cantharellus,* if only wrinkled or rugose or smooth it should be found in *Craterellus.* As *Craterellus* is related on the one side to *Cantharellus,* so it approaches *Clavaria* on the other, and club shaped forms may be placed in either genus by different authors. These complicated relationships emphasize the impossibility of placing all related groups in juxtaposition in a lineal arrangement of genera. For full treatment of the genus see Burt, Ann. Mo. Bot. Garden **1**: 327. 1914. Also see Peck, N. Y. St. Mus. Bull. **2**: 44. 1887.

KEY TO THE SPECIES OF CRATERELLUS

Plant rosy on dorsal surface, hymenium and stem white ..... *C. roseus* (3)

Plant entirely egg yellow.

Stem solid ..... *C. cantharellus* (1)

Stem hollow ..... *C. odoratus* (2)

Not entirely egg yellow or rosy.

Plant tubular, with cavity to or near the base.

Cap and stem drab when fresh, darker smoky-drab when old; pubescence at base of stem not buffy ..... *C. cornucopoides* (4)

Cap drying to leather color or snuff-brown, base with buffy pubescence ..... *C. ochrosporus* (5)

Plant less tubular, yellowish-brown to fuscous, 1.5-3 cm. wide, hymenium and stem yellow ..... *C. lutescens* (6)

Plant less than 1 cm. wide, hymenium creamy-buff ..... *C. calyculus* (7)

1. Craterellus cantharellus Schw.

PLATES 4, 5 AND 16.

Plants medium to large, gregarious, often cespitose, firm and solid, growing in low woods and in swamps; not common. Cap up to 14 cm. wide, slightly or rather strongly depressed in center at maturity, the margin uplifted and arched, strongly sinuate or lobed; surface smooth, even, dry, about egg yellow. Flesh thick, firm, with the fragrance of *Cantharellus cibarius.*

Hymenium varying from quite smooth to distinctly rugose-wrinkled over most of the surface, the very margin nearly always slightly rugose at least, the wrinkles anastomosing; color distinctly salmon.

Stem up to about 6 cm. long, expanding upward into the cap, always bent, surface smooth, texture solid and quite firm.

Spores (of No. 1157) a distinct and pretty salmon pink, elliptic, smooth, 4-4.5 x 5-8μ*.

In Ann. Mo. Bot. Garden **1**: 330. 1914, Burt remarks:

"This species is so similar to *Cantharellus cibarius* in habit, coloration, size and form—differing from the latter only in the more even hymenium—that figures of *C. cibarius* will serve very well for *Craterellus Cantharellus*, if allowance is made for the different hymenium. The firm and solid stem of *C. Cantharellus* distinguishes this species from *C. odoratus* easily."

1157. Low grounds of New Hope Creek, about 200 yards below bridge on Durham road, July 18, 1914. Photo.
In this collection of many fine plants the largest was 12.5 cm. high and 14 cm. wide. The venation was confined to about 2 cm. of the margin except in the very largest plants and in no case did the veins extend to the stem (see photo).

1584. Same spot as No. 1157 and just like that collection only smaller, June 26, 1915. Spore surface almost smooth.

*In N. Y. St. Mus. Bull. 1, No. 2, p. 47, Peck says: "The spores . . . have a yellowish or salmon-yellow tint."

PLATE 4

CRATERELLUS CANTHARELLUS, No. 1157

PLATE 5

CRATERELLUS CANTHARELLUS, No. 1157

1600. Near branch west of Meeting of the Waters, not far from "Judge's Spring," July 13, 1915.

Blowing Rock. Atkinson.
Asheville. Beardslee.
North Carolina. Schweinitz.

2. **Craterellus odoratus** Schw.

PLATES 6 AND 16.

A peculiar plant with numerous small, funnel-shaped caps arising from a common solid stem; entire plant 5.5-7.5 cm. high, up to 7 cm. wide above; stem sometimes distinct, about 2 cm. long and 1.5 cm. thick, creamy white to ochraceous, glabrous, somewhat pitted and channeled, solid, firm, sometimes disappearing in a fused mass; flesh color of surface. Caps arising in all directions from the top of the stem, varying from very small up to 3.5 cm. long and 3 cm. wide, prettily trumpet-shaped, the margin crimped and wavy, narrowed below and hollow to the base, upper (inner) surface a beautiful chrome yellow (about deep chrome of Ridgway), finely *floccose-tomentose;* hymenium salmon-pink, quite smooth; flesh light yellow, about 1.3 mm. thick; taste and odor exactly that of *Cantharellus cibarius.*

Spores ochraceous-yellow, elliptic, smooth, many bent, 3.7-4.8 x 7.4-10.3μ.

I take our plant to be a much-branched form of *C. odoratus,* although other descriptions do not mention the floccose-tomentose surface. (See Burt, loc. cit., p. 331.)

Under the name of *Cantharellus odoratus* No. 1288, Curtis refers to this species in the Curtis-Berkeley Mss. as follows:

"Light yellow, very smooth, and destitute of plicæ, outer surface glaucous, 1-2 in. high, infundibuliform, hollow to the base of the stipe. Sporidia white. Sides of banks in woods."

2408. Mixed woods west of Meeting of the Waters, July 20, 1916. Photo.
2642. In path, low damp woods by branch back of athletic field, July 11, 1917.
2701. Rich woods, Battle's Park, July 16, 1917.
2761. Mixed woods north of cemetery, July 24, 1917. Photo.

Salem. Schweinitz.
Low and middle earth in woods. Curtis.

3. Craterellus roseus Fr.

This species is known only from the original collection by Schweinitz, probably near Salem. The description below is taken from Burt, (Ann. Mo. Bot. Garden **1**: 333. 1914):

"Fructifications solitary, somewhat fleshy; pileus infundibuliform, somewhat strigose, pallid rose, the margin lobed and inflexed; stem apparently stuffed, attenuated downward, white; hymenium somewhat rugose, white.

"In mosses, especially in proximity to *Kalmia*. North Carolina.

"Specimens of this species have the habit of *Cantharellus cibarius* but are thinner. Fries received a specimen of *Craterellus roseus* from Schweinitz and expressed the opinion in 'Elenchus' that the species is good. I have seen no specimens of *C. roseus* and base the above on the original description and the comments by Schweinitz and Fries."

4. Craterellus cornucopioides L.

PLATES 1 AND 16.

Plants up to 12 cm. tall and 5.5 cm. broad, shaped like a long cornucopia and hollow to the base, the margin broadly drooping or rarely plane, wavy, upper and inner surface squamulose-fibrous, most so near the margin, color exactly drab to light drab of Ridgway, blackening on drying. Flesh very thin, tough and elastic, color of surface, odor distinctly musty-fragrant, faintly like that of *Cantharellus cibarius,* taste slight, similar.

Spore surface glaucous, fleshy-drab color, not at all veined, but somewhat channeled and pitted or quite smooth in places, extending half way down the stem, or farther.

Stem fading into the cap, grayish drab, the base lighter and tomentose, not ochraceous below the hymenium, hollowed to the base, usually bent and pinched.

Spores a distinct salmon-pink color, elliptic, smooth, some bent, 5.9-7.4 x 10.8-13μ.

When rubbed and in age all parts become darker and sometimes quite black in places, but when perfectly fresh the colors are lighter than usually described. Descriptions of the spores as white or hya-

PLATE 6

CRATERELLUS ODORATUS, No. 2408 (left), No. 2761 (right)

line must have been made from old prints after the spores had faded, as they are distinctly a clear salmon-pink when at all fresh.

2195. Mixed woods, pasture near Mr. Pritchard's, June 22, 1916. Photo.
2536. In moss in damp woods back of athletic field, June 20, 1917.
3261. In moist, shady place among moss and liverworts in cemetery, May 30, 1909. Painting.

Asheville. Beardslee.
North Carolina. Schweinitz.

5. **Craterellus ochrosporus** Burt.

Plants 3-4 cm. high, stalk 2-2.5 cm. long, smooth, and black except at base which is covered with a minute creamy-buff tomentum; hollow to base; above it expands rather suddenly to the funnel-shaped cap about 1-1.5 cm. wide, which is brown and rough squamulose on the upper (inner) surface. The hymenium (outer surface) is smooth and a buffy flesh color. Texture fleshy, but toughish and flexible.

Spores smooth, elliptic, 7.4-10 x 11-14.4μ. They are said to be straw-yellow but we did not get a heavy enough print to determine this point.

I have followed Burt in recognizing this species, but without conviction that it is distinct from the preceding.

1959. On a mossy bank by branch below Strowd's spring, November 3, 1915.

6. **Craterellus lutescenes** Pers.

This has not yet been found in Chapel Hill and the following is from Burt (Ann. Mo. Bot. Garden **1**: 336. 1914):

"Fructifications solitary to cespitose; pileus thin, somewhat membraneaceous, varying from convex and umbilicate to tubiform or funnel-shaped, often pervious, yellowish brown to fuscous, with margin often lobed or irregular; stem flexuous, cylindric, hollow, yellow, drying ochraceous buff, often hairy at the base; hymenium remotely ribbed, even or rugose-wrinkled, yellow, drying cadmium-yellow to ochraceous buff; spores even, 10-12 x 6-8μ.

"Fructifications 2½-5 cm. high; pileus 1½-3 cm. broad, stem 1½-4 cm. long, 2-4 mm. thick.

"On moist ground in woods and swamps. Newfoundland to North Carolina and westward to Michigan. August to October.

"This species probably ranks next to *C. cornucopioides* in frequency in the United States. The long and yellow stem readily distinguishes this species from *C. ochrosporous*. Specimens of *Cantharellus infundibuliformis* resemble those of *Craterellus lutescens* in form, size, and color, but those of the former species have true lamellæ."

Blowing Rock, Atkinson.
North Carolina. Schweinitz.
Low district, earth and woods. Curtis.

7. Craterellus calyculus (B. and C.) Burt.

Not yet found in Chapel Hill and known only from North Carolina and South Carolina. The following is from Burt (Ann. Mo. Bot. Garden **1**: 338. 1914):

"Fructifications somewhat fleshy-membranaceous; pileus thin, deeply cup-shaped, minutely tomentose, drying Saccardo's umber, opaque; stem apparently hollow, cream buff, attenuated below, tomentose at the base; hymenium even or slightly venose, cream buff; spores slightly yellowish under the microscope, even, 8 x 6μ.

"Fructifications 2-3 cm. high; pileus 4-8 mm. broad; stem 1 cm. long, 1-2 mm. thick.

"On ground in damp shady woods. North and South Carolina. August and September.

"Upon moistening, the type in Kew Herbarium proved too soft and fleshy and the hymenium too waxy for a *Stereum*. The sections have the structure of *Craterellus*. The species is near *C. sinuosus* and may prove to be a small form of this when ample material gives more complete knowledge of the species, but, for the present, I regard *C. calyculus* as a distinct species. I refer to *C. calyculus* a collection made by Professor Atkinson at Blowing Rock, North Carolina, the rough-dried and cespitose specimens of which show a somewhat tubiform pileus and spores. 7-8 x 4½μ."

Blowing Rock. Atkinson.
Low district, moist woods. Curtis.

CANTHARELLUS

Plants fleshy, growing on the ground or (in one case) on wood, stem central or laterally attached in one species, gills fold-like or somewhat thin and approaching those of a Hygrophorus with an obtuse edge, cap usually depressed in center, sometimes infundibuliform; spores buff or ochraceous or rosy pink or light salmon.*

Important literature:

Murrill, N. Am. Flora **9**: 167. 1910.
Peck, N. Y. State Cab. Rep. **23**: 121. 1872.
Peck, N. Y. State Mus. Bul. **2**: 34. 1887.

KEY TO THE SPECIES OF CANTHARELLUS

Stalk none or lateral, growing from the stems of living mosses.
  Plant with a lateral stalk; cap glabrous.....*C. muscigenus* (2)
  Plant sessile, cap finely downy.....*C. retirugus* (1)
Stalk central, not growing on mosses.
  Growing on rotting logs.....*C. lignatilis* (12)
  Growing on ground.
    Cap pallid brown, gills ashy vinaceous.....*C. infundibuliformis* (3)
    Cap grayish-drab, black when bruised, odor very musky .....*C. sinuosus* (4)
    Cap grayish-brown, gills white or creamy.....*C. umbonatus* (11)
    Cap buffy-brown with lilac tint, flesh lilac.....*C. clavatus* (8)
    Entire plant cinnabar red or cap red and gills orange .....*C. cinnabarinus* (9)
    Cap some shade of yellow or orange.
      Cap deeply infundibuliform, stem hollow.
        Plants thin, small, less than 5 cm. broad..*C. infundibuliformis* (3)
        Plants larger, over 5 cm. broad.....*C. floccosus* (5)
      Cap flat or only depressed, stem solid.
        Cap and gills orange.
          Gills distant .....*C. cinnabarinus, orange form* (9), *and C. minor* (10)
          Gills close .....*C. aurantiacus* (7)
        Cap and gills yellow or creamy.....*C. cibarius* (6)

*Most authors speak of the spores as white for the genus, but this is not the case with our Chapel Hill plants. In all of our species so far collected the spores have been distinctly colored, when fresh. The color gradually fades in the herbarium. Beardslee writes me that the spores of Asheville plants show similar colors.

1. Cantharellus retirugus (Bull.) Fr.

Dictyolus retirugus in N. Am. Fl. **9**: 166.

PLATES 7 AND 16.

Cap up to 1 cm. broad (said to reach 2 cm.) quite sessile by the dorsal surface, often hanging from center, but usually eccentric or almost laterally seated at times, bell or shell-shaped when young, then more expanded to saucer-shaped or broadly petalloid; very thin and delicate, nearly pure white and finely downy when young, so that the incurved margin is delicately fimbriate, at maturity the down collapses and the surface fibers split and separate like the surface of a cocoon.

Gills very rudimentary, composed of irregular folds or veins in center which may branch and deliquesce quite irregularly, fading away before the margin is reached, or the surface may seem merely pitted (as in Auricularia) rather than veined, and often is almost smooth; when young the hymenium is nearly white, then pale ashy straw, the upper surface making the same change or remaining more whitish.

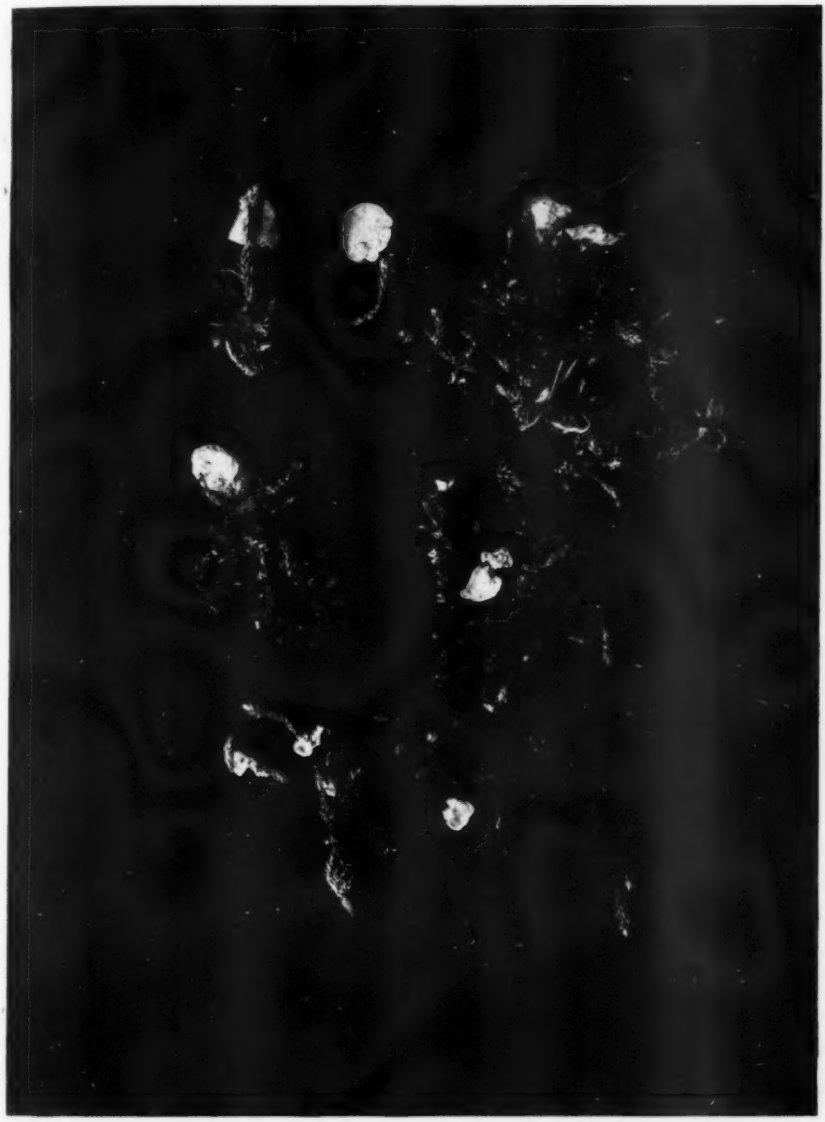
Spores (of No. 3224) pure white, smooth, subelliptic to pip-shaped, 4-4.5 x 6.6-8.5μ.

The place of attachment is usually a mm. or more wide, the surface fibers disappearing into the moss. So exceedingly delicate is the plant that it dries up to an earth gray or darker crumpled particle so inconspicuous as to be found with difficulty even on preserved material where it is known to be plentiful. It breaks easily from the moss when dry and revives very little when moistened.

This is certainly *C. retirugus* and not *C. muscigenus*. Bulliard's figure (Pl. 498, fig. 1) represent our plants exactly. It has not been reported heretofore south of our most northern states and ranges northward to Alaska and Greenland. Schweinitz reports *C. muscigenus* from North Carolina, but not this species. We have not found the former.

3224. Parasitic on a moss, bank by road east of campus. Jan. 27, 1919. Photo. Plentiful.

PLATE 7



CANTHARELLUS RETIRUGUS. No. 3224.

2. **Cantharellus muscigenus** Fr.

We have not found this plant and take the description from Murrill (N. Am. Flora **9**: 165. 1910, as Dictyolus). It is easily distinguished from *C. retirugus* by the lateral stalk, darker color, glabrous cap and less delicate substance. For good illustrations see Bulliard, Pl. 498, fig. 2, and Cook, Illustrations of British Fungi Pl. 1115 (1065).

"Pileus submembranaceous, laterally stipitate, spatulate, 1-2.5 cm. broad; surface glabrous, zonate, fuscous to whitish cinereous; margin entire to undulate or lobed; lamellæ distant, dichotomous, concolorous; spores ellipsoid, smooth, hyaline, 10-12 x 6-9μ; stipe short, concolorous or slightly darker, villose at the base."

Middle district on mosses. Schweinitz.

3. **Cantharellus infundibuliformis** (Scop.) Fr.

Gregarious or cespitose. Cap. 2-3.3 cm. broad, irregular, deeply depressed in center and at times with a hole in the center leading down into the hollow stem; margin undulate, broadly drooping or almost plane; surface peculiar, roughened by pits, channels and ridges, the latter terminating in small, pointed squamules which are much more numerous towards the margin; color varying from a reddish ochraceous orange, near capucine orange, to a pallid brown. Flesh toughish, fleshy, tinted like the cap, only 1-1.5 mm. thick, almost tasteless and quite odorless.

Gills distant, connected by large, irregular veins, a few forking, the wider ones about 2.5 mm. broad, with narrower ones between, the edges fairly sharp for a cantharellus, especially in fully mature plants; color varying from a dull salmon, exactly salmon-buff of Ridgway at maturity, to ashy vinaceous.

Stem 2-4.5 cm. long, 3-4 mm. thick in center, smooth, clear orange color, much more brightly colored than the other parts usually, straight or crooked and irregularly, flattened, pinched or channeled, quite hollow from top to bottom, the cap pierced and opening into this hollow in only two of our collections, often so in others.

Spores buffy-salmon, elliptic, smooth, 5.5-8.5 x 8-11.8μ.

A very variable plant, particularly in color of cap and gills, but easily recognized by the clear orange color of the cavernous stem. Bresadola figures a branched or densely cespitose form that he calls var. *subramosus* (Fungi Trident. 1: 87, Pl. 97). The colors shown are not accurate for our plant.

1549. Woods south of athletic field, June 18, 1915.
2200. Sandy soil in low places in woods near Mr. Pritchard's, June 20, 1916. Photo.
2325. Edge of path along northern Meeting of the Waters branch, mixed woods, June 30, 1916.
2353. Pine woods south of cemetery, July 3, 1916.
2681. Low damp woods, Battle's Park, July 13, 1917. Cap perforated into the stem.
2706. Damp woods near Battle's Branch, July 17, 1917. Cap perforated into the stem.
2757. In humus, upland woods, Battle's Park, July 22, 1917.
3263. Under oaks, Battle's Park, May 30, 1919. Painting.
3346. Low woods in front of cemetery, June 12, 1919.

Blowing Rock. Atkinson.
Middle district (Schw.) woods among leaves. Curtis.
Asheville. Beardslee.

4. **Cantharellus sinuosus** Fr.

PLATES NO. 9 AND 16.

Plants about 3-7 cm. high, rather abruptly expanded above and strongly crenated and lobed, the margin elevated or drooping; surface lightly ridged and grooved, somewhat felted and slightly squamulose, especially near the margin, the center passing down gradually into the hollow stem, or at times with more of the appearance of having been perforated into the stem; color grayish-drab, blackening in age or when bruised. Flesh toughish, elastic, only 1-2 mm. thick, color of cap, odor a very decided musky fragrance, taste not distinct.

Hymenium composed of vein-like wrinkles, which are more elevated radially, with lower and irregular anastomosing ones, all blunt and not more than 1 mm. high, color like that of cap with a tint of flesh added, moderately decurrent.

PLATE 8

CANTHARELLUS INFUNDIBULIFORMIS. No. 2200.

PLATE 9

CANTHARELLUS SINUOSUS, No. 2284

Stem 2-4 cm. long, irregular, more or less ridged and longitudinally rugose, color of cap but usually lighter, hollow except at the base.

Spores white apparently (spore print too light to be sure), elliptic, smooth, some bent, 3.7-5 x 6.6-9.6μ.

From the strong odor of this plant I refer it to *Cantharellus sinuosus* Fr., but the spores are more like those of *C. cinereus* Fr., as described, which is not decidedly odorous. It is easily distinguished from *C. infundibuliformis* by the odor, color, and much smaller spores.

2284. Base of a rotting deciduous stump near Dr. Pratt's, June 28, 1916. Photo.

2675. At foot of white oak by Battle's Branch, July 14, 1917. Odor strongly aromatic.

5. **Cantharellus floccosus** Schw.

PLATES 10, 11 AND 16.

Plants gregarious, sometimes cespitose. Width up to 13.5 cm. or more and height the same, very deeply infundibuliform, the depression running way down the stem, the margin erect, except at complete maturity when it is spread out and may be beautifully fluted. Color of surface orange, very deep or light orange when old, covered with a flocculence which becomes soft and agglutinated when wet. Flesh of all parts white except just under the surface, thin, only about 5 mm. thick, somewhat acid in taste, no smell.

Gill surface running way down the stem, the low broad ridges so much anastomosed as to have no individuality for any distance except on stem. Color creamy with light tints of pinkish or orange brown, the marginal parts lighter.

Stem usually bent below, tapering downward and pointed at base and continuous with and not distinct from cap; hollow to near the base.

When young the plant is shaped like a long hollow club, growth later taking place above and forming the spreading top.

Spores (of No. 1588) ochraceous yellow, elliptic, smooth, 7-8 x 12-15μ.

Illustrations: Peck. Edible Fungi, Pl. 55, figs. 9-13, also Report N. Y. St. Mu. **52**: pl. 60, figs. 10-14.

Montreat. Rich humus under Rhododendron and Hemlock by branch, July 6, 1915. (No. 1588.) Photos. W. C. Coker.
Blowing Rock. Atkinson.
Middle and upper districts. Curtis.

6. **Cantharellus cibarius.** Fr.

PLATES 1, 12 AND 16.

Cap usually from 2.5-6 cm. broad, rounded when young, depressed or flat when old, the margin nearly even or wavy, bent down when young, plane or elevated when mature. Surface smooth or minutely roughened, deep chrome-yellow, or paler yellow. Flesh yellow under the surface, nearly white elsewhere, firm and toughish, odor of apricots in our plants. Taste pleasant, usually slightly peppery.

Gills low but rather thin, about 1 mm. deep, branching about twice, decurrent, anastomosing somewhat but not conspicuously, chrome yellow or lighter.

Stem about 3-4 cm. long to the gills, usually bent, nearly equal, smooth, pale yellowish or cream color, tough, firm and solid.

Spores (of No. 1599) a clear orange-yellow, exactly color of the gills in a heavy print (but see No. 1168, below) elliptic, smooth, 4-5.5 x 7-8μ.

Distinguished from *Craterellus cantharellus* by the distinct salmon-pink spores, the more orange color of cap and gills, and by the lower, more vein like and often absent gills of that species.

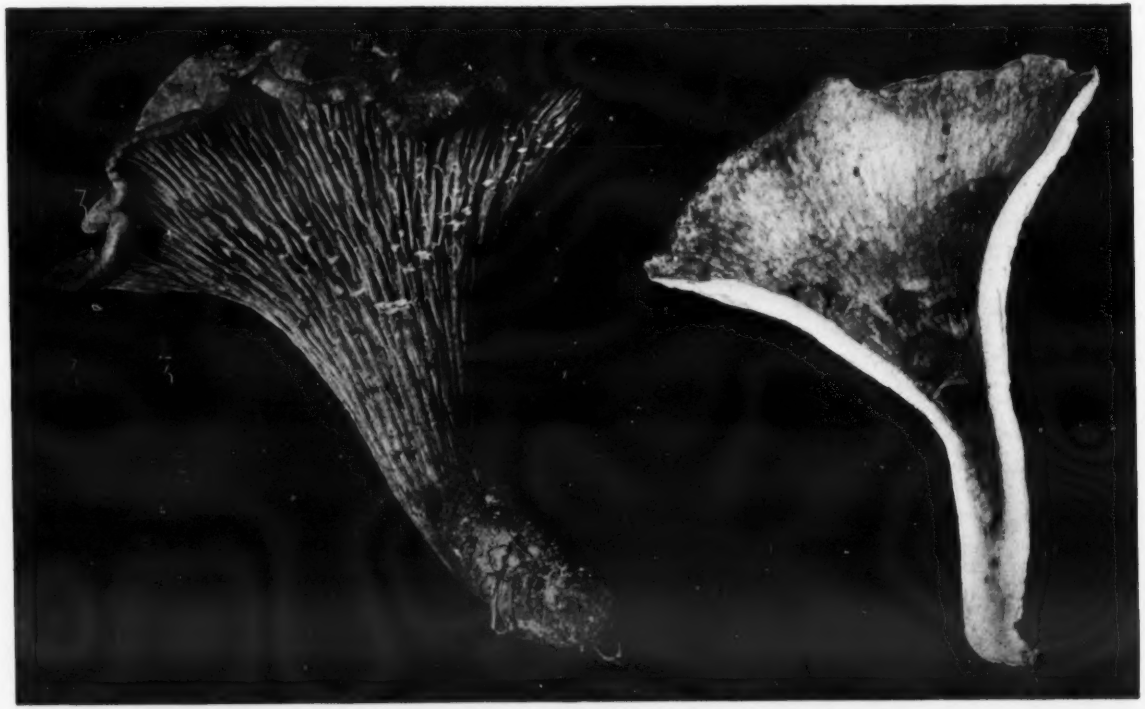
Illustrations: Gibson. Our Edible Toadstools and Mushrooms, pl. 19; Taylor. Food Products III, p. 4; Peck, N. Y. St. Mu. Bull. **150**: pl. 122, figs. 8-16.

195. Battle's Park, near Dr. Battle's house, September 14, 1910.
699. Damp, cool spots along Battle's branch, June 20, 1913.
1168. In hollow below sphagnum moss bed and by old road southeast of athletic field, July 20, 1914. Photo. Spores salmon pink, exactly as in *Craterellus cantharellus*, elliptic granular, some with an oil drop, 3.7-4.6x7.4-9.2μ. Except for the spore color these plants are exactly *Cantharellus cibarius*.
1547. In pine woods, near path to Judge's Spring, June 18, 1915. Spores light buff (Ridgway), elliptic, smooth, 4.5-5.5 x 7.2-9μ.

PLATE 10

CANTHARELLUS FLOCCOSUS, No. 1588

PLATE 11



CANTHARELLUS FLOCCOSUS, Reduced ⅙. No. 1588

1557. By path near branch west of Meeting of the Waters, June 19, 1915. Spores light buff, 4.5-5.4 x 7.2-9.5μ.
1564. In several spots along Battle's branch, June 20, 1915. Photo.
1599. In woods near branch, west of the Meeting of the Waters, July 13, 1915. Photo.
1610. On bank above Howell's Branch, July 15, 1915.
2321. Oak grove at Gimghoul Lodge, June 30, 1916. Montreat, July 6, 1915. No. 1590. Coker. Spores elliptic, smooth, light buff, 4.5-5.4 x 6.8-8μ.
2728. Mixed upland woods, Battle's Park, July 20, 1917. Cap 9.6 cm. broad.
3292. Battle's Grove and Park, June 2, 1919. Painting.

Blowing Rock. Atkinson.
Common in Woods. Curtis.
Asheville. Beardslee.

7. **Cantharellus aurantiacus** Fr.

We have not found this species in Chapel Hill, and the description below has been kindly furnished by Mr. H. C. Beardslee. The species is very different from others of the genus, the thin, broad gills forking like those of an Agaric. It is also easily distinguished from *C. cibarius* and *C. cinnabarinus* by the white instead of salmon-colored spores. In the state Herbarium at Albany, N. Y., there are specimens up to 12 cm. broad.

"Cap rounded hemispherical, becoming expanded and plane or depressed, 3-7 cm. broad, somewhat tomentose, dull orange. Flesh thin at the margin, which is at first incurved and irregular. Gills thin, crowded, forking, decurrent, and bright orange. Stem 2-6 cm. long, 4-8 mm. thick, colored like the cap, but darker at the base, nearly smooth above, tomentose below. Spores white, 4-5 x 6-8μ.

"In woods, growing on and around well decayed logs.

"This species is very distinct from *C. cibarius*. The bright orange gills which are much broader and thinner than in *C. cibarius* at once distinguishing it. At Asheville it is not common, but is found every summer."

Illustrations: Cook. loc. cit. Pl. 1104 (1057); Atkinson. Mushrooms, figs. 127 and 128. Gillet. Champ. de Fr. Pl. 86 (141); Richon et Roze. Atlas Champ. Pl. 49, figs. 16-19. Michael, Führer f. Pilzfreunde **1**: Pl. 29.

Middle District. Schweinitz.
Blowing Rock. Atkinson.
Asheville. Beardslee.

8. Cantharellus clavatus Pers.
Cantharellus brevipes Pk.

PLATES 13, 14 AND 16.

Plants clustered and some with fused stems, up to 16 cm. broad and 16 cm. high, deeply infundibuliform or with only slightly elevated margins and undulately plain; the margins sometimes bent down, sometimes straight; surface nearly smooth, slightly pruinose, the very thin superficial layer easily splitting into fibers so that the surface becomes marked with lines and areas where the lighter colored layer shows; color buffy-brown, distinctly tinted with lilac, which is the result of the *deep lilac flesh* showing through. The color varies in different parts of the cap, the margin as it dries showing little lilac. As the plant gets old a rosy tint is added to the lilac flesh and also to the cap, and this may grow deeper until both become rosy red with a tint of lilac. The rosy color of the cap becomes darker and sordid as decay begins. Flesh of the cap soft and spongy, but not fragile; taste very mild and pleasant.

Gills rounded, vein-like, composed of ridges and folds that are approximately parallel towards the margin, anastomosing more downwards and strongly decurrent. The color of the gills and surface between is a deep lavender brown, much deeper than the cap, and with the maturity of the spores their cinnamon color is added to the other tints as an obviously superficial dusting.

Stem about 6-8 cm. long, tapering downward, solid, much more firm than the cap, nearly smooth and colored like the hymenium except at the base which is white; the flesh like that of the cap, a deep lavender, turning through gray to white at base. The plants are often fused at base and several caps may arise from one stem. The stem is usually central, but may be lateral through the failure of the caps to expand on one side. When placed on white paper when fresh the gills leave a permanent light lavender stain.

Spores cinnamon-buff, long-elliptic, smooth, 3.7-4.6 x 12-15.7μ.

This interesting and very rare plant is new to the South, and has been collected only a few times even in the North. Murrill in N. Am. Flora **9**: 171. 1910, lists it as doubtful, saying "It does not

PLATE 12

CANTHARELLUS CIBARIUS, No. 2321*a*

PLATE 13

CANTHARELLUS AURANTIACUS *(Photo by Beardslee)*

PLATE 14

CANTHARELLUS CLAVATUS, Reduced 1/5·3. No. 918

PLATE 15

CANTHARELLUS CLAVATUS, Reduced 1/6-5. No. 918

appear to be sufficiently distinct from *C. floccosus.*" It is, however, very different from the latter and is quite distinct. (See Mycologia **5**: 261. 1913.)

The species is placed under Craterellus by Burt (Ann. Mo. Bot. Gard. **1**: 329. 1914). There is good authority either way, and the two genera are very closely connected.

Illustrations: Bresadola. Funghi. Mangr. Pl. 82. (as Cantharellus); Krombholz. Abbild. u. Beschr. Pl. 45. figs. 13-17 (as Cantharellus.)

918. On ground in deciduous woods on hillside, north side of Rocky Ridge Farm. Oct. 16, 1913. Three Photos.
927. In mixed open woods near Judge's Spring, Oct. 18, 1913.

9. **Cantharellus cinnabarinus** Schw.

PLATES 1, 15 AND 16.

Cap. 1.5-4 cm. broad, umbilicate and the margin inrolled when young, then funnel shaped from the elevation of the margin, often crenated or strongly lobed, surface soft, fibrous, smooth or more often roughish or subtomentose or minutely squamulose, dry, dull; color a strong and characteristic cinnabar-red all over, typically, but varying to a clear strong orange all over and with all intermediate shades. Flesh thin, toughish, color of the cap or lighter; taste mild or slightly to distinctly peppery; odor aromatic, like that of *C. cibarius.*

Gills distant, strongly decurrent, about 1-2 mm. wide, connected by thick, low veins, about color of cap or sometimes orange when the cap is cinnabar.

Stem slender, toughish, firm, solid, about 2-2.5 cm. long and 2-3.5 mm. thick, smooth or roughish, about color of cap.

Spores a pretty rosy pink when fresh in cinnabar plants, but varying to pale orange in orange plants, fading after a time in the herbarium, elliptic, smooth, about 4-6 x 6-9μ.

This is an attractive and easily recognized little species that is usually found on mossy soil near branches or in low places in woods. It is very common with us and is excellent as an edible. The orange form may contrast strongly with the cinnabar plants and are confusing to beginners. The color is, however, the only difference, and one often meets with cinnabar plants with contrasting

orange gills and there are all color shades between deep cinnabar and strong orange. Old plants may become very pale and blotched with dull white. The spores partake of the color of the gills. Odor, taste, size, shape, surface and spores are all identical in the different color forms.

Peck has described a small orange plant, 1-2.5 cm. broad, as *C. minor*, and Atkinson has found it at Blowing Rock. In Chapel Hill many plants of *C. cinnabarinus* are as small as this and I can detect little if any other difference of consequence from the description. However, not knowing these to be the same, I include *C. minor* with the strong suspicion that it is not distinct.

196. Battle's Park, near Dr. Battle's house, mixed woods, Sept. 14, 1910. Spores 4-6 x 6-9μ.
371. Battle's Park, by branch, Oct. 18, 1911.
546. Battle's Park, near branch, Oct. 10, 1912. Photo.
1189. By branch southeast of Graded School, July 22, 1914.
1251. By Battle's branch, at Lover's Leap, Sept. 23, 1914.
1548. Low woods near Meeting of the Waters, June 18, 1915. Orange form. Spores exactly as in red form, except for color which was *orange pink*. 3.6-5.4 x 7.2-10μ.
1556. Damp soil in hollow below Sphagum bed, July 19, 1915. Spores elliptic, smooth, 4.6-5.4 x 7.2-10μ.
1565. By old Raleigh Road, under pines northeast of Judge Brockwell's, June 20, 1915. Spores rosy pink.
1634. Damp soil by Meeting of the Waters branch, July 23, 1915. Spores a pretty rosy-pink color when fresh, elliptic, smooth, 3-5.4 x 6.8-8μ.
2341. Woods, Chapel Hill, July 2, 1916. Photo.
3265. Low place in deciduous woods, Battle's Park, May 30, 1919. Painting.
3360. By Battle's branch, June 24, 1919. Spores light orange color, 4-5.1 x 7.4-9.3μ. Painting.

Asheville. Beardslee.
Common in damp woods (as Hygrophorus). Curtis.

10. **Cantharellus minor** Pk.

This plant is probably only a form of *C. cinnabarinus*, as mentioned above.

The following is from Murrill (N. Am. Flora **9**:169. 1910):

"Pileus thin, fleshy, convex to expanded, irregular or depressed at times, gregarious, 1-2.5 cm. broad; surface glabrous, subrugose, ochraceous to orange; margin inrolled at first, entire or repand: con-

PLATE 16

CANTHARELLUS CINNABARINUS, No. 546

text thin, pallid, mild, at length faintly peppery; lamellæ decurrent, distant, very narrow, often forking, seldom anastomosing, concolorous: spores ovoid, somewhat one-sided, smooth, hyaline with a faint yellowish tinge, 8-9 x 4-5μ: stipe slender, cylindric, equal, glabrous, shining, slightly striate at times, concolorous, usually solid, 2-5 cm. long, 2-4 mm. thick."

Blowing Rock. Atkinson.

11. **Cantharellus umbonatus** Fr.

The following is from Murrill (N. Am. Flora **9**: 170. 1910):

"Pileus obconic, usually umbonate, convex to expanded, often depressed, fleshy, flexible, gregarious, 1.5-4 cm. broad; surface flocculose to glabrous, usually smooth, dry, varying from light to dark grayish-brown, margin regular, involute, concolorous; context white, thin, mild, edible; gills decurrent, white or yellowish-white, becoming reddish when wounded, close, regular, more or less dichotomous: spores narrowly ellipsoid, smooth, hyaline, 8-10 x 4μ: stipe 3-8 cm. long 4-8 mm. thick, equal or tapering upward, subglabrous, solid, whitish tomentose at the base, white or colored like the pileus above."

I find this note by Curtis in the Berkeley-Curtis Manuscript:

2837. "(Canth. umbonat., Fr.) Cap 1-1½ in. broad, acutely umbonate and depressed, pale fuliginous and scaly, margin thin involute, exceeding the gills. Lam. whitish. subcrowded, narrow, ascending from the stipe, subarcuate, all 3-5 forked. Stipe subequal, 1-2 in. long, 2 lines thick, rather paler than the cap, solid, appressed, fibrillose, base white mycelose. Spores white! Among leaves in dry woods. Nov."

Illustration: Cook. loc. cit., Pl. 1106 (1058).

Common, woods among leaves. Curtis.

12. **Cantharellus lignatilis** B. and C.

This species does not seem to have been found since its first collection by Ravenel, and our knowledge of it is quite meager. It may not be a Cantharellus.

The original description is as follows (Ann. Mag. N. H. **44**: 294. 1859):

"Reddish-brown; pileus 2 in. across, smooth, infundibuliform, deeply striate, stem 2 in. or more high, 1/4–1/3 in. thick, smooth;

folds thin, decurrent. Of this we have no notes, but the peculiar habit and characters will distinguish it. Curt. No. 1979. On rotten logs, S. C., H. W. Ravenel."

Low district, on carious wood. Curtis.

PLICATURELLA

Plants laterally attached, sessile or with a short stalk, subfleshy; gills fold-like; spores rust color; no veil. This genus differs from Cantharellus in the lateral attachment and rusty spores.

There is but one species.

Plicaturella olivacea (Schw.) Murrill

Cantharellus olivaceus Schw.

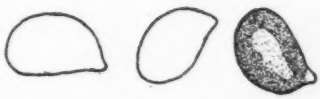
The following is from Murrill (N. Am. Flora **9**: 172. 1910): "Pileus subfleshy, dimidiate, subimbricate, slightly depressed, 2.5-4 cm. broad, 3-4 mm. thick, sessile or attached by a short thick stipe which is black and strigose; surface yellowish-green, pulverulent or finely pubescent, margin subinflexed, undulate or lobed: context homogenous, olivaceous, fragile when dry, 2.5-3 mm. thick; lamellæ anastomosing, dichotomous or branched, crowded, rather broad, orange-yellow to reddish-brown; spores ovoid, smooth, ferruginous, 5 x 4μ."

Salem. Schweinitz. Type locality.

CHAPEL HILL, N. C.

PLATE 17

Nyctalis asterophora, No. 1789



Craterellus cantharellus, No. 1157

Craterellus odoratus, No. 2642

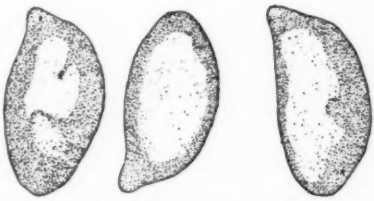
Cantharellus retirugus, No. 3224

Craterellus cornucopoides, No. 2195

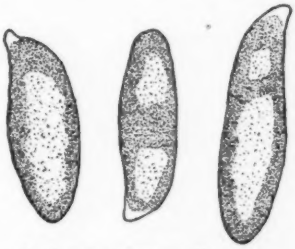
Cantharellus sinuosus, No. 2284

Cantharellus infundibuliformis, No. 2200

Cantharellus cibarius, No. 2319

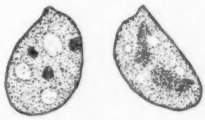


Cantharellus floccosus, No. 1588



Cantharellus clavatus, No. 918

Cantharellus cinnabarinus, orange form, No. 1548



Cantharellus cinnabarinus, No. 1556

No. 1789 x 670. All others x 2160

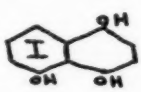
JUGLONE

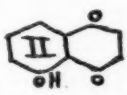
By Alvin S. Wheeler

The American supply of dyes was very suddenly cut off when the Great War began in 1914, and the ports of Germany were blockaded. We were forced to turn to natural dyestuffs and to increase our production of synthetic dyes. The progress in American manufacture has been so great that the production of dyes in the United States in 1917 was nearly equal in total weight to the annual importations before the war.

NATURAL DYESTUFFS

The natural coloring matters are very numerous but they are not always fast and their quality is not apt to be uniform. The most important plants which are used as a source of commercial dyestuffs are indigo, logwood, madder, cutch, fustic, turmeric, archil, sandal wood and quercitron bark. There are, however, many other sources of dyes and among these is the walnut hull, long used on the small scale by the thrifty housewife. The coloring matter has great tinctorial power as any one knows who has removed the hulls from walnuts. When these hulls are used and this is still done at the present day, the dye imparted to the goods is a beautiful brown and is very fast. I am told that the dye is also obtainable from the leaves, bark and roots of the walnut tree. The walnut hull contains an aromatic compound called [a]hydrojuglone which is a phenol in the naphthalene series with hydroxyl groups at positions 1, 4 and 5. Its formula therefore is (I).





It is with great difficulty soluble in water, forming a one-half per cent solution at 25°C. It is readily soluble in alkaline liquids, forming intense yellow solutions. This is most likely the dye which has been used so much, especially by the farmer's wife. This hydro-

juglone is very readily oxidized, even by iron chloride, to juglone, the subject of this paper. The oxidation affects the hydroxyl groups at positions 1 and 4, removes the hydrogen atoms and thus produces a quinone (II). Juglone is therefore 5-hydroxy-1-4-naphthoquinone.

HISTORY OF JUGLONE.

Juglone was first mentioned by Vogel and Reischauer[1], who obtained it from fresh walnut hulls. It is next referred to by Phipson[2] who called it regianin. His product was evidently not pure. In 1877 Griessmayer[3] published Reischauer's notes on juglone (the first appearance of this name) giving an analysis of this compound and its copper salt. The names given above are derived from the botanical name of the walnut tree, Juglans regia. Bernthsen[4] gave a number of reasons for believing it to be an hydroxynaphthoquinone. Bernthsen and Semper[5] extracted 150 kilograms of ripe walnut hulls with ether and obtained a yield of 150 grams or 0.1% of pure juglone. By the action of nitric acid they obtained juglonic acid or dinitrohydroxyphthalic acid, showing that the hydroxyl group in juglone is in the benzene ring. Mylius[6] fused juglone with potash and obtained m-hydroxybenzoic acid and salicylic acid. Bernthsen and Semper[7] prepared the dioxime, having made the monoxime earlier. These reactions established the constitution of juglone as being 5-hydroxy-1, 4-naphthoquinone. Finally Bernthsen and Semper[8] synthesized juglone by oxidizing 1, 5-dihydroxynaphthalene with chromic acid, obtaining a yield of 30-40 per cent, a record which I have never been able to make. I have varied the process in many ways and never get more than 16 per cent. The acetyl derivative and the monoxime of the synthesized juglone were found to be identical with those obtained from the natural juglone.

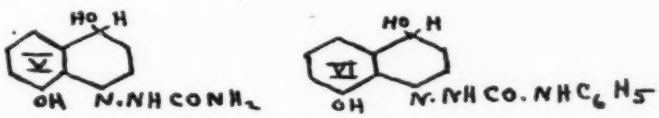
---

[1]Buchner Neues Repert. für Pharm. **5**: 106. 1856; L' Institut 1857, 71.
[2]Compt. rendus., **69**: 1372. 1869.
[3]Ber.desdeutsch.Chem.Ges., **10**: 1542. 1877.
[4]Ber.d.d.Chem.Ges. **17**: 1945. 1884.
[5]Ber.d.d.Chem.Ges., **18**: 203. 1885.
[6]Ber.d.d.Chem.Ges., **18**: 463. 1885.
[7]Ber.d.d.Chem.Ges., **19**: 164. 1886.
[8]Ber.d.d.Chem.Ges., **20**: 934. 1887.

THE HYDROJUGLONES

Not only juglone but also $^{\alpha}$-hydrojuglone and its isomer, $^{\beta}$-hydrojuglone, have been the subjects of considerable study in the Organic Laboratory of the University of North Carolina. The first important discovery was the demonstration that the two hydro-juglones were isomeric keto and enol forms, their formulas being III and IV:

This investigation was begun in the chemical laboratory of the Swiss Federal Polytechnic at Zurich and was completed in Chapel Hill. The report is found in the Berichte d.d.Chem.Ges., 47, 2796 (1914). That the alpha compound contains three hydroxyl groups is shown by its conversion into a triacetyl derivative with acetic anhydride. That there is no ketone group present is shown by our failure to obtain an oxime or a semi-carbazone. The beta-compound also forms a triacetyl derivative but this is because the acetic anhydride has an enolizing action, causing the hydrogen in position 1 to move to position 4, thus reforming the alpha-compound. However, ketone reagents such as semicarbazine and phenylsemicarbazine readily convert the beta-compound into semicarbazones, V and VI:



These two reagents are successful because of their weak basic properties. The hydrojuglones are very sensitive to alkalies, so that the usual ketone reagent, hydroxylamine, decomposes them instead of giving an oxime. Semicarbazine is less basic on account of the presence of the carbonyl group and phenylsemicarbazine is still less basic since it contains in addition the phenyl group. This gives a strong hint that phenylsemicarbazine should be a delicate reagent for those ketophenols which are particularly sensitive to alkalies.

HALOGENATION OF HYDROXYNAPHTHOQUINONES.

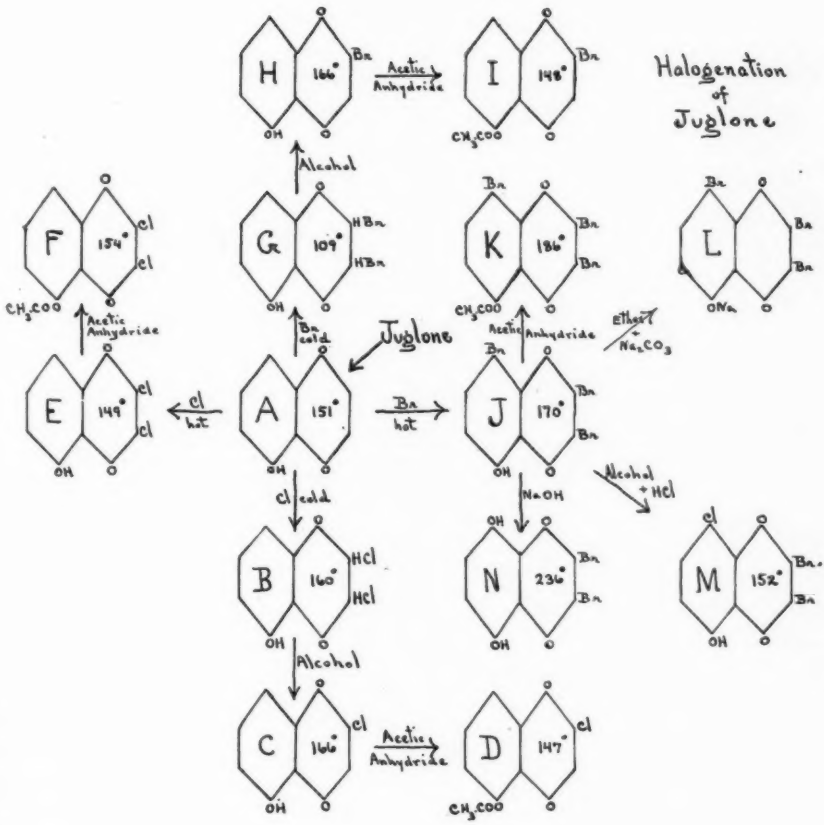
The next investigation undertaken here was the behavior of juglone with the halogens, chlorine and bromine. This work was done with the assistance of J. W. Scott, candidate for the degree of Doctor of Philosophy. Very little work indeed has been published on the behavior of naphthoquinones with halogens. Diehl and Merz[9] discovered 3-bromo-2-hydroxy-naphthoquinone. Kehrmann and Mascioni[10] prepared the analogous iodo compound. Zincke and Schmidt[11] made naphthazarine dichloride and 2-chloronaphthazarine. That is a very short story. In 1917 I published with V. C. Edwards[12] our study of the bromination of naphthazarine and of 1,4,5,6-tetrahydroxynaphthalene, reporting eight new derivatives of the first compound and nine of the second. If we add to this the new work on the halogenation of juglone, we see that this very small field has been very greatly extended, and the end is not yet.

HALOGENATION OF JUGLONE.

The accompanying chart (pl. 18) shows clearly in outline the work on the halogenation of juglone. Chlorine and bromine were used, the juglone being dissolved in all cases in glacial acetic acid. The action of the halogens is very different in a hot acid solution from that in a cold solution. If the halogen is added to a cold solution, the addition products, B and G, are obtained. These are called juglone dichloride and juglone dibromide. Each of these loses one molecule of halogen acid by the action of warm alcohol, yielding the monohalogen substitution products, C and H. The proof that these still contain the hydroxyl group is shown by the ready formation by acetic anhydride of the acetyl derivatives, D and I. If, however, the halogens are added to hot solutions of juglone, then substitution products are obtained which are far more stable than the addition compounds. We find here, however, a difference in the action of the halogens for, strange to say, juglone takes up only two chlorine atoms, E, as against three bromine atoms, J. These compounds behave in the same way

[9]Ber.d.d.Chem.Ges., **11**: 1066. 1878.
[10]Ber.d.d.Chem.Ges., **28**: 345. 1895.
[11]Annalen der Chemie, **286**: 41. 1895.
[12]Jr.Amer.Chem.Soc., **39**: 2460. 1917.

PLATE 18


Halogenation of Juglone
H
166°
Acetic Anhydride
I
148°
Alcohol
F
154°
G
109°
K
186°
L
E
149°
Juglone
A
151°
J
170°
Ether + Na2CO3
Cl hot
Br hot
Br cold
Cl cold
Alcohol + HCl
NaOH
B
160°
N
236°
M
152°
C
166°
D
147°

with acetic anhydride, giving the acetyl derivatives, F and K. Much more attention has been paid to tribromojuglone than to dichlorojuglone. Tribromojuglone, on being heated with an alcoholic solution of hydrochloric acid loses one bromine atom which is replaced by a chlorine atom, M. Again, on being heated with an alcoholic solution of caustic soda, one bromine atom is replaced by the hydroxyl group, N. These two reactions indicate that one bromine atom is unlike the other two, that is, its environment must be different. This fact is expressed in the formula given, in which one bromine atom is placed in position 8. This gives a unique position to one bromine atom, placing it in the phenol ring where it ought to be more reactive. On the other hand, the other two bromine atoms being alike are therefore placed symmetrically in the quinone ring. Finally tribromojuglone forms a sodium salt, L.

NEW DYES.

Dichlorojuglone consists of golden brown needles and tribromojuglone of brilliant rich red needles. Being highly colored and containing at the same time a reactive hydroxyl group these compounds should be typical dyes, and my experiments have shown that they are in reality very beautiful dyes. So far more attention has been paid to tribromojuglone. If this compound is dissolved in ether and the solution is shaken with an aqueous solution of sodium carbonate, an indigo blue salt separates out. This readily dissolves in water. If a piece of silk or wool is placed in the solution and the solution is boiled, the purple color of the solution quickly changes to a yellow, showing a reaction between the textile and the sodium salt. Silk is thus dyed a very beautiful champagne and wool a medium shade of tan. No mordant is necessary to fasten the color on the goods. However, if mordants are used the shades are changed in a number of instances, especially with wool. In only one instance was a change noticed with silk, a tin mordant producing a greenish bronze tint. Cotton is not affected by the dye unless it is mordanted. If the cotton is first impregnated with tannic acid, and then with the dye, it assumes an ecru color.

The dichlorojuglone is also a dye and imparts to silk a rich reddish bronze color. Other compounds such as C, H, M and N are un-

doubtedly dyes, but their dyeing properties have not yet been studied. No dyes so far described in the literature or patented belong to this series of naphthalene compounds, hence they constitute a new group. An application for letters patent has been made to cover this new class and the patent will undoubtedly soon be allowed.

THE NEW HALOGEN JUGLONES.

A brief description of these new halogen derivatives of juglone follows. Juglone dichloride,B, lemon yellow plates, recrystallized from ligroin, melts at 159-160°. Monochlorojuglone,C, yellowish brown needles, purified by carbon tetrachloride, melts at 166°, but gives off a violet vapor above 130°. Acetyl monochlorojuglone,D, brownish yellow plates, recrystallized from alcohol, melts at 147°. Dichlorojuglone,E, lustrous golden brown needles, recrystallized from alcohol, melts at 149°. Acetyl dichlorojuglone,F, yellow plates, recrystallized from alcohol, melts at 154°. Juglone dibromide,G, yellow prisms with pointed ends, recrystallized from ligroin, melts at 109°. Monobromojuglone,H, translucent yellowish brown plates, recrystallized from acetone, melts at 166°. Acetyl monobromojuglone,I, golden brown plates, recrystallized from alcohol, melts at 148°. Tribromojuglone,J, rich red needles, recrystallized from a mixture of chloroform and ligroin, melts at 170°. Acetyl derivative,K, silky yellow needles recrystallized from alcohol, melts at 186°. Monochlorodibromojuglone,M, golden bronze plates, recrystallized from alcohol, melts at 152°. Dihydroxydibromojuglone,N, golden brown prismatic needles, recrystallized from alcohol, melts at 236°. The sodium salt,L, is an indigo blue powder.

CHAPEL HILL, N. C.

OUR RATS, MICE AND SHREWS

By C. S. Brimley

Rats and mice, both native and introduced, are the most numerous as the most destructive of our mammals, and as shrews are always caught to a greater or less extent when trapping for field mice, I have also added what little information I had about them.

Rats and mice belong to the family Muridæ, and there are no other mammals in this region liable to be confused with them, except the jumping mouse, which, although mouse-like in general appearance, belongs to the Jerboidæ, and is also included in this paper.

Shrews belong to the Insectivora, family Soricidæ, and are characterized by small size, normal limbs, pointed snouts, and an unbroken tooth row, differing markedly in this last respect from rats (and all other rodents) in which there is a wide gap between the incisors and the molars.

The species we get at Raleigh are (1) Introduced Forms: Wharf or Brown Rat, Roof Rat, House Mouse. (2) Native Rats and Mice: White-footed Mouse, Red or Golden Mouse, Ricefield Rat, Harvest Mouse, Cotton Rat, Meadow Mouse, Pine Mouse, Jumping Mouse. (3) Shrews: Southern Shrew, Carolina Mole Shrew, Little Mole Shrew. This make a total of eleven rats and mice and three shrews. One more mouse occurs in the eastern part of the State, and about three more mice and an equal number of shrews in the mountains.

In size the Wharf and Roof Rats class as large rats, the Cotton and Ricefield Rats and the Meadow Mouse as medium sized or rather small rats, the other mice and the shrews do not exceed the size of average or small mice.

In color the three introduced species, the Ricefield Rat and the Harvest Mouse might be said roughly speaking to be mouse colored, the Whitefooted, Red, and Jumping Mice are yellowish brown or tawny, the Meadow Mouse dark brown and the Pine Mouse, chestnut brown. The shrews incline to ashcolored or plumbeous, dark or light, though some of the longtailed forms are more or less chestnut

in color. Their pointed snouts and mole-like fur are characteristic.

Of the introduced species the two large rats are apt to be confused, but weight seems to be diagnostic as the heaviest roof rat I have weighed tipped the scales at only 5 1/2 ounces while the smallest adult wharf rat weighed over 7, and the largest 21 ozs, with an average of not less than 11 or 12 ozs. The tails, too, differ in length, the tail of the roof rat when stretched forward over the back reaching well beyond the nose, while that of the wharf rat does not come much further forward than the ears. Roof rats appear to be more diurnal in habit, and usually seek to escape if possible by climbing upwards while a wharf rat instinctively goes down. Neither species seems to occur in the fields in this locality.

The house mouse occurs both in and around human habitations and in fields far from the haunts of man. It is not likely to be confused with anything else but the harvest mouse, which, however, has much softer fur, a blunter snout, and more distinctly whitish underparts. Fortunately, too, it has a structural difference in that there is a groove down the anterior face of its upper incisors, which is absent in the house mouse.

Of the native species the commonest is the whitefooted or deer mouse, which is not likely to be confused with any other of our Raleigh species except the red mouse from which it differs totally in habits, being terrestrial while the other is an arboreal form. The deer mouse is tawny on the sides with a darker area on the back, the color of the sides and the white of the underparts abruptly distinct, not shading into one another, tail bicolored, white below, tawny above. This species is found everywhere in fields and in woodlands, often forming fifty per cent of the mice and shrews caught when trapping. It seems to nest mostly in rotten stumps or logs either above or below ground.

The species most closely resembling the deer mouse is the red or golden mouse which differs from all the rest of our rats and mice by its arboreal habits. This is a species of low grounds and thickets along streams, building its nests in small trees, reeds or thickets often as high as fifteen feet from the ground. Usually an inspection of the nests will tell if the mouse or mice are at home, as the hole is usually open when they are away, and closed when the inmates are

at home. Each nest is inhabited by a pair of mice with or without a brood of young according to the season of the year, the last brood apparently remaining in the nests with their parents throughout the winter. This is a slightly larger species than the deer mouse, and is more reddish in color, the dark area along the back is less marked and the color of the upper parts shades into the yellowish white of the underparts without a break. The species is never caught in field trapping for mice and I have caught but one in a trap in the woods. The young are colored like the adults unlike those of the deer mouse which are slate colored above.

The commonest of the field mice next to the deer mouse is the little harvest mouse, which occurs as commonly but less uniformly, and does not seem to be found at all in the woods. Its characteristics have been noted in connection with the house mouse.

By far the largest of the field rats and mice is the cotton rat, a stouter built animal and with a proportionately shorter tail than any so far mentioned. This attains a length of from 8 1/2 to over 10 inches with a tail less than two-fifths of its total length, the color is grizzled due to an admixture of yellow tipped hairs with black ones. The species seems to be often very common in honeysuckle tangles on upland ditch banks, and it seems more closely confined to upland fields in this vicinity than any other of our species. Traps for small mice are too small for it, and it will often tear the wooden ones to pieces to get at the bait.

Another good sized species of quite different habits is the rice field rat or rice rat, which casually much resembles a small house rat in appearance. In total length it measures about the same as the cotton rat, but as its tail constitutes about one-half of the total length it is actually much smaller. Its home is in the marshes and cat tail swamps along streams and it swims and dives as readily as a musk-rat, its hind feet being larger in proportion than those of most other mice.

The other two species of Muridæ occurring here are distinguished from all the foregoing by their short ears and very short tails which latter are less than three-tenths of the total length. The larger is the meadow mouse a dark brown good sized mouse mainly inhabiting lowground meadows, but found to a greater or less extent in all up-

land fields, average length about 6 3/4 inches of which the tail constitutes only 2 7/8 inches. This is a potential menace as are all its near relatives to alfalfa and other hay crops.

The smaller of the shorttailed mice occurring here is the pine mouse which is much smaller than the meadow mouse and with still shorter ears and tail. It is more subterranean in its habits than the other mice, both making burrows of its own and following the mole runs under the surface of the ground. It is said to be a more of a woodland species than the other mice, but is captured more or less sporadically in field trapping. In many respects it is a more insidious enemy than our other mice, for the damage it does to potatoes (either kind) or peanuts is not apt to be noticed until the crop is dug and empty shells alone are found.

We now come to the jumping mouse which like the red mouse seems to be untrappable in this locality, though specimens are not infrequently found drowned in the barrels set for muskrats. This is a yellowish species with the coarse harsh fur partly composed of black hairs, and the underparts are yellowish white. The tail is over half of the total length and the hind feet are proportionately very large, its usual method of progression being by leaping like a frog. The species seems to be mostly confined to lowgrounds or the borders of small streams, and is not at all common, Raleigh being, I believe, the most southern locality from which it is known.

Of the shrews there are two groups, the longtailed shrews with the tail more than one-third the total length and the ears more conspicuous, and the short-tailed or mole shrews with the tail less than one-fourth the length and the ears hidden by the fur, the latter look very like diminutive moles, and are often mistaken for young moles by the uninformed in spite of the marked difference in their forefeet from those of a mole.

Of the longtailed shrews we get at Raleigh only one species, the smallest and rarest of our small mammals, *Sorex longirostris,* a little animal only about 3 1/2 inches long of which the tail constitutes 1 1/4, the few specimens taken by me have all been caught in traps in fields, none in woods.

Of the mole shrews we get two species, the Carolina mole shrew, which is about 3 3/4 inches long, the tail only 3/4 inch, and the little mole shrew, which is barely 3 inches long, with the tail 5/8 inch. The latter is usually somewhat paler than the Carolina shrew, but is not always easy to distinguish except by dental characters. Both species are found in fields and the Carolina shrew also in woods, and both can be caught in traps baited with peanuts, which I find to be practically the only bait worth using for field mice and shrews, although the heads of birds and mice can be used to trap shrews and most species of mice.

A few words about trapping small mammals. I find that the best traps to use so far as catching specimens is concerned are the ordinary wooden choker mouse traps, cut in half and set in the runways; the guillotine traps are also good, but shrews and mice seem to have a preference for seeking their food in a hole, thus I have caught cotton-rats in choker traps when their heads were wedged so tight in the hole that it was hard to get them out.

The best season for trapping mice and shrews so far as the number caught is concerned is from about mid-November to Christmas, but those caught later on are in more adult condition and better pelage. As soon as vegetation begins to grow rapidly in the spring the number caught rapidly diminishes, and by early April trapping is about done for.

The following measurements will give some idea of the comparative size and proportions of our species:

Species	Average All Specimens			Average Large Ones			Largest One	
	Number	Total Length	Tail	Number	Total Length	Tail	Total Length	Tail
1. Deer Mouse (*Peromyscus leucopus*).	170	5.75	2.38	26	6.50	2.87	7.00	3.12
2. Golden Mouse (*Peromyscus aureolus.*)	143	6.38	3.00	26	6.93	3.31	7.31	3.63
3. Rice Rat (*Oryzomys palustris.*)	71	8.25	4.06	13	9.81	4.81	10.56	5.25
4. Harvest Mouse (*Reithrodontomys humulis.*)	160	4.56	2.06	32	5.12	2.50	5.56	2.50
5. Cotton Rat (*Sigmodon hispidus.*)	108	8.56	3.38	23	9.93	3.81	10.87	4.50
6. House Mouse (*Mus musculus.*)	21	5.87	2.75				6.75	3.25
7. Roof Rat (*Mus alexandrinus.*)	51	14.25	7.68	11	15.87	8.87	17.12	9.38
8. Wharf Rat (*Mus norvegicus.*)	4	17.25	7.98				20.00	9.50
9. Meadow Mouse (*Microtus pennsylvanicus*).	101	6.81	1.87	10	7.38	2.00	7.93	2.38
10. Pine Mouse (*Pitymys pinetorum.*)	80	4.68	.93	8	5.12	.93	5.12	.93
11. Jumping Mouse (*Zapus hudsonius.*)	23	7.81	4.56				8.68	5.25
12. Southern Shrew (*Sorex longirostris.*)	8	3.38	1.25				3.62	1.44
13. Carolina Mole Shrew (*Blarina Carolinensis.*)	108	3.68	.75	14	3.87	.81	4.06	.93
14. Mole Shrew (*Blarina brevicauda.*)	5	4.68	1.06				5.00	1.06
15. Little Mole Shrew (*Cryptotis parva.*)	93	2.93	.62	11	3.25	.68	3.62	.68

All specimens from Raleigh except 18 Deer Mice, 24 Golden Mice, 10 Harvest Mice, and 15 Little Mole Shrews from Bertie County, N. C., and the 5 Mole Shrews from Buncombe County, N. C.

NOTES ON THE FLORA OF CHURCH'S ISLAND, NORTH CAROLINA

By W. L. McAtee

Church's Island, North Carolina, lies in about the center of Currituck County, which occupies the northeastern corner of the State. It is about four miles long and is bounded on the east by Currituck Sound, on the north by Mills Bay, on the west by Oldtown Creek and on the south by The Creek. The last is scarcely more than a ditch and separates Church's Island from what is called Narrow Shore, along the Sound and from Piney Island farther inland.

Church's Island has a rather high bank along most of the Sound side, and slopes smoothly, though but slightly to the marsh bordering Oldtown Creek on the west. The soil is about the same everywhere, a sandy loam and differences in vegetation are due chiefly to variations in soil moisture. The higher land on the Sound side supports practically all of such trees as red cedar, prickly ash, hackberry, live-oak and Carolina buckthorn. Willow and ash are found only about springy places, while persimmon, mulberry, holly and papaw are rather generally distributed. Loblolly pine, the dominant tree, which fixes the character of landscapes on the island, solidly occupies that part of the island from the marsh to a road running north and south the whole length of the island. Formerly no doubt it similarly dominated land to the east, from which it has been cleared to permit cultivation.

Cultivation has either introduced or opened the way for numerous weeds of which the most conspicuous in fields are fennel, white heath aster, ragweed, redroot, lambs-quarters, Mexican tea, love-grass, partridge pea, morning-glory, butter-print, jimson-weed and *Eupatorium capillifolium*. In gardens purslane, carpet-weed, black nightshade, horse nettle, crabgrass, ribgrass and smartweed are most common. Introduced plants now spontaneous include paper mulberry *(Broussonetia papyrifera)*, here bearing the old name Otaheite mulberry, black locust *(Robinia pseudacacia)*, crepe myrtle *(Lagerstræmia indica)**, youpon *(Ilex vomitoria)* and sweet violet *(Viola odorata)*.

**Lagerstroemia indica* is usually described as a shrub. However, it makes a tree if given a chance. There are several trees on Church's Island 18 inches in diameter.

The fig *(Ficus carica)* and china-berry *(Melia azedarach)* also are cultivated, but do not appear to reproduce themselves. An interesting series of plants, evidently introduced to Church's Island by commercial operations were discovered about the end of Waterlily wharf and along the road leading from it. These included seaside knotweed, pepper-grass, self-heal, catnip, heliotrope, squash and sow thistle.

The two most prominent plant associations of Church's Island are the marsh and the pine woods. The marshes are of two kinds, (1) smaller spots on the Sound side of the island in which narrow-leaved cat-tail is the dominant growth, and bulrush *(Scirpus validus)*, Baccharis and Iva common, and (2) the marsh into which the whole inland side of the island merges where broad-leaved cat-tail, two species of marshgrass *(Spartina glabra* and *S. polystachya)*, a rush *(Juncus effusus var. solutus)* and a bulrush *(Scirpus robustus)* are most abundant.

In the pine woods, cucumber tree, sweet gum, persimmon and holly are scattered here and there; the most abundant herbs are two grasses: *Uniola laxa* and *Andropogon scoparius.* About the middle of the island is a grove of tall loblolly pines, which has been undisturbed except for grazing in the nine years of its history cognizant to the writer, and probably for a long time before. Aside from the marshes this woods evidently is the nearest to virgin growth of any vegetation on the island. In it were found a number of plants not seen elsewhere, including partridge berry, two kinds of violet *(V. triloba* and *V. septemloba)*, jessamine, creeping cucumber, meadow-beauty *(Rhexia)*, pennywort *(Centella)* and an aster *(A. salicifolius?)*.

The writer's visits to Church's Island have embraced the following periods: August 31 to September 9, and November 24 to December 15, 1909, and October 10-21, 1918. Collecting plants, except the aquatics occupied only a small part of the whole time. This fact together with the unfavorable season for botanizing renders the following list incomplete. Nevertheless it is hoped that these notes will have some value since they refer to a region for which no local flora has been published.

The writer greatly appreciates the assistance of Mrs. Agnes Chase, W. R. Maxon, S. F. Blake and G. P. Van Eseltine in determining plants of groups in which they specialize. For other names in the list the writer is responsible, and those of Aster and Solidago should be treated with reserve. Of the English names given the first is the book or otherwise recognized name, if there is a worthy one; any others are local names in use on Church's Island. The authorities for botanical names are spelled out except in the case of Linnæus who named so large a proportion of plants of the Middle Atlantic States. Notes are included on the stage of flowering or fruiting observed, data which is lacking in too many local lists. For this purpose the following abbreviations are used: fl., flower; fr., fruit; imm., immature; mat., mature. When fr. only is used maturity is to be assumed. When no month accompanies these notations October is to be understood.

LIST OF PLANTS

Subkingdom Euthallopthyta (Algæ, etc.)

Chara spp. Muskgrass, nigger wool, oyster grass. Blankets the bottom of almost the whole of Currituck Sound; oögonia, August—October.

Subkingdom Pteridophyta (Ferns, etc.)

FAMILY OSMUNDACEÆ

Osmunda regalis L. Royal fern, a few plants seen, in marsh and other wet places.

FAMILY POLYPODIACEÆ

Dryopteris thelypteris (L.) A. Gray. Marsh Shield-fern.; common in marsh.
Polypodium polypodioides (L.) A. S. Hitchcock. Gray Polypody. A few plants seen on trunk of sweet gum.

Subkingdom Spermatophyta. (Seed plants.)

FAMILY PINACEÆ

Pinus tæda L. Loblolly pine. The dominant tree of the island, reproduction admirable; produces wood enough for the requirements of the island without diminution of the stand. The fallen needles are carefully gathered for use as a stable litter; in this state they are called straw or pine-straw.

Juniperus virginana L. Red cedar. Common along high bank of Sound; less so elsewhere, but grows even in edge of marsh; some specimens dwarfed by grazing are very dense and remarkable in appearance; fr.

FAMILY TYPHACEÆ

Typha latifolia L. Broad-leaved cat-tail. Abundant in marsh forming inner side of island.

Typha angustifolia L. Narrow-leaved cat-tail. The principal constituent of marshy patches bordering Sound.

FAMILY ZANNICHELLIACEÆ

Potamogeton perfoliatus L. Clasping-leaved pondweed, redhead grass. Common in Sound, especially over muddy bottoms.

Potamogeton foliosus Rafinesque. Leafy pondweed. Scarce in Sound; common in ponds and streams of marsh.

Potamogeton pectinatus L. Sago pondweed; foxtail grass; extremely abundant in Sound; the dominant plant; fr. Aug.-Oct.

Ruppia maritima L. Wigeon grass. Scattered in Sound; apparently not as common as in 1909. Ripe akenes Sept.

FAMILY NAIADACEÆ

Naias flexilis (Willdenow) Rostkovius and Schmidt. Bushy pondweed. Abundant in Sound.

FAMILY ALISMACEÆ

Sagittaria latifolia Willdenow. Wapato. Common in marsh.

Sagittaria teres Watson. Goose grass. In 1909 this was abundant in very shallow water along shore of Sound; in 1918 I did not see it; fl. Sept.

Sagittaris graminea Michaux. Scarce in shoal water of Sound; fls. Sept.

Sagittaria subulata (L.) Buchenau. Abundant on mud along edge of marsh. fls.

FAMILY VALLISNERIACEÆ

Philotria canadensis (Michaux) Britton. Waterweed. Scattering near shore in Sound.

Vallisneria spiralis L. Wild celery. Abundant in Sound; especially along channels and in places over soft muddy bottom; also in creeks in marsh; fls. Aug.-Sept., fr. October.

FAMILY GRAMINEÆ

Erianthus saccharoides Michaux. Plume grass. Scattered in marsh; mat. fr.

Schizachyrium scoparium (Michaux) Nash. Broom beard-grass. Common; mat. fr.

Andropogon virginicus L. Broom-sedge. Common; mat. fr.

Syntherisma sanguinale (L.) Dulac. Crab-grass. Abundant weed in fields; mat. fr.

Paspalum longipilum Nash. In old pine woods; mat. fr.

Paspalum distichum L. Joint grass. Along roads.

Echinochloa crusgalli (L) Beauvois. Common, along ditches; fr.

Panicum dichotomiflorum Michaux. Common in woods; fruit mostly fallen.
Panicum virgatum L. Switch grass. Common.
Panicum anceps Michaux. In old pine woods; mat. fr.
Panicum condensum Nash. Common along ditches and other wet places; fr.
Panicum longifolium Torrey. In woods near marsh; mat. fr.
Panicum ciliatum Elliott. Wet woods near marsh; fr. mostly fallen.
Panicum roanokense Ashe. In woods near marsh; fr. mostly fallen.
Panicum scoparium Lamarck. Common in wet places.
Chætochloa viridis (L.) Scribner. Green foxtail. Common weed; fr.
Muhlenbergia schreberi Gmelin. Scarce in woods.
Cinna arundinacea L. Reed-grass. Along ditches; mat. fr.
Spartina polystachya Elliott. Along ditches and creeks in marsh.
Spartina glabra Muhlenberg. One of the chief components of the marsh; mat. fr.
Eleusine indica (L.) Gærtner. Yard-grass. Common weed in gardens; also along roads.
Eragrostis ciliaris (L.) Link. Abundant weed in fields; glumes empty.
Uniola laxa (L.) Britton, Sterns and Poggenburg. Abundant in woods; mat. fr.
Distichlis spicata (L.) Greene. Salt-grass. Abundant in marsh, and along ditches; fr.
Elymus virginicus L. Wild rye. A single colony seen in yard of old abandoned homestead. mat. fr.
Arundinaria tecta (Walter) Muhlenberg. Maiden cane. Not common.

FAMILY CYPERACEÆ

Cyperus diandrus Torrey. Marsh. mat. fr.
Cyperus rivularis Kunth. About Waterlily wharf and road, also edge of marsh; mat. fr.
Cyperus dentatus Torrey. About Waterlily wharf and road. mat. fr.
Cyperus erythrorhizos Muhlenberg. Common.
Cyperus strigosus L. Common; mat. fr. Sept.-Oct.
Cyperus lancastriensis Porter. Weed, fls. to mat. fr.
Cyperus hystricinus Fernald. Pine woods; mat. fr.
Cyperus ovularis (Michaux) Torrey. Old pine woods; mat. fr.
Cyperus cayennensis (Lamarck) Britton. In woods near marsh; mat. fr.
Cyperus globulosus Aublet. Weed in corn field; mat. fr.
Eleocharis obtusa (Willdenow) Schultes. Common, edge of Marsh; mat. fr.
Eleocharis tuberculosa (Michaux) Rœmer and Schultes. Common in marsh; mat. fr.
Scirpus validus Vahl. Great bulrush. Common in marshy patches bordering Sound; mat. fr.
Scirpus robustus Pursh. Abundant in marsh.
Fuirena hispida Elliott. Scarce in marsh.
Carex festucacea Willdenow. Common in woods; mat. fr.
Carex albolutescens Schweinitz. In old pine woods; mat. fr.

FAMILY LEMNACEÆ

Lemna minor L. Duckweed. Abundant along edge of marsh.

FAMILY JUNCACEÆ

Juncus effusus L. var. solutus Fernald and Wiegand. One of the principal components of the marsh; produces very little fruit.
Juncus tenuis Willdenow. Scattered along roads; fr.
Juncus setaceus Rostkovius. In wet places, pine woods; fr.
Juncus marginatus Rostkovius. Common in marsh; fr.
Juncus canadensis J. Gay. Common in marsh; fr.
Juncus acuminatus Michaux. Scattered in pine woods; fr.

FAMILY PONTEDERIACEÆ

Pontederria cordata L. Pickerel-weed. Common along edge of marsh.

FAMILY SMILACACEÆ

Smilax herbacea L. Carrion flower. Fruit collected Nov. 1909.
Smilax glauca Walter. Greenbrier. Common; fr.
Smilax rotundifolia L. Common; fr.
Smilax bona-nox L. Common; fr.

FAMILY AMARYLLIDACEÆ

Hypoxis hirsuta (L.) Coville. Yellow Star-grass. Scattered near edge of marsh. Fls.

FAMILY ORCHIDACEÆ

Ibidium ovale (Lindley) House. Common in marsh. Fls.

FAMILY SAURURACEÆ

Saururus cernuus L. Lizard's tail. Common along edge of marsh.

FAMILY JULANDACEÆ

Juglans nigra L. Black Walnut. A few tree present.

FAMILY MYRICACEÆ

Myrica carolinensis Miller. Abundant, occurring on almost all parts of the island; becomes a tree; a specimen 25 feet high with trunk a foot in diameter seen.

FAMILY SALICACEÆ

Salix nigra Marsh. Willow. Scattered about wet spots particularly along shore of Sound.

FAMILY FAGACEÆ

Quercus virginiana Miller. Live Oak. Only one seen on high shore of Sound.

FAMILY ULMACEÆ

Celtis mississippiensis Bosc. Hackberry. Common along high shore of Sound; fr. Sept.-Oct.

FAMILY MORACEÆ

Morus rubra L. Red mulberry. A few trees, in pine woods and on high shore of Sound.

FAMILY URTICACEÆ

Pilea pumila (L.) A. Gray. Rich-weed. In wet places.
Bœhmeria cylindrica (L.) Swartz. Collected in fruit; Sept. 1909.

FAMILY POLYGONACEÆ

Rumex crispus L. Sour dock. Common weed. Mat. fr.
Polygonum maritimum L. Seaside knotweed. A few plants about Waterlily wharf, Fl. to mat. fr.
Tovara virginiana (L.) Rafinesque. Common along woodland road; mat. fr., Sept.-Oct.
Polygonum lapathifolium (L.) S. F. Gray. Common weed; fr.
Persicaria pennsylvanica (L.) Small. Smartweed; common weed in gardens; mat. fr. Sept.-Oct.
Persicaria hydropiperoides (Michaux) Small. Marsh. Mat. fr.
Persicaria punctata (L.) Opiz. Water pepper. Common in marsh, and wet places in general. Fls. to mat. fr. August to October.
Tracaulon sagittatum (L.) Small. Common along edge of marsh.
Tracaulon arifolium (L.) Rafinesque. Edge of marsh. Immature and mature akenes Sept. 1909.
Tiniaria scandens (L.) Small. Climbing false buckwheat. Common.

FAMILY AMARANTHACEÆ

Amaranthus retroflexus L. Redroot. Common weed; fls. to mat. fr.

FAMILY CHENOPODIACEÆ

Chenopodium album L. Lambs-quarters. Common weed.
Chenopodium ambrosioides L. Mexican tea. Common weed; fls. to fr.

FAMILY PHYTOLACCACEÆ

Phytolacca americana L. Poke-weed. Common, fr.

FAMILY AIZOACEÆ

Mollugo verticillata L. Carpetweed. Common in gardens; fls. to fr.

FAMILY PORTULACACEÆ

Portulaca oleracea L. Purslane. Common weed in gardens.

FAMILY NYMPHAEACEÆ

Castalia odorata (Dryand) Woodville and Wood. White Waterlily. Common in pools along edge of marsh.

FAMILY MAGNOLIACEÆ

Magnolia virginiana L. Sweet Bay. Not common; fr. Sept.
Magnolia acuminata L. Cucumber tree. A few trees in pine woods.

FAMILY ANNONACEÆ

Asimina triloba (L.) Dunal. Papaw. Scattered in pine woods; fruit ripe in September, fallen by October; evidently does not require frost for ripening as believed in some localities north; the same remark applies to persimmons. On my first visit to Church's Island, in 1909, I found to my surprise that papaws were not only not eaten by the inhabitants, but were actually regarded as poisonous.

FAMILY RANUNCULACEÆ

Clematis virginiana L. Common; fr.

FAMILY CRUCIFERÆ

Lepidium virginicum L. Pepper-grass. Waterlily road. Fls. to mat. fr.

FAMILY ALTINGIACEÆ

Liquidambar styraciflua L. Sweet Gum. Scattered; more at the north end than elsewhere.

FAMILY ROSACEÆ

Rubus trivialis Michaux. Blackberry. Common.
Rosa carolina L. Swamp rose. Common in edge of marsh and other wet places; fls. to mat. fr.

FAMILY MALACEÆ

Cratægus crus-galli L. Red haw. One tree; Oct. fruit not yet ripe.

FAMILY AMYGDALACEÆ

Prunus americana Marsh. Wild plum. Common.
Prunus angustifolia Marsh. Chickasaw Plum. Common.
Padus virginiana (L.) Miller. Wild Black Cherry. A few seen.

FAMILY CÆSALPINACEÆ

Chamæcrista fasciculata (Michaux) Greene. Abundant; fr.
Gleditsia triacanthos L. Honey Locust. A few trees on high bank near Sound.

FAMILY FABACEÆ

Trifolium repens L. White clover. Common weed.
Lespedeza striata (Thunberg) Hooker and Arnott. Japan clover. Common weed; mat. fr.
Glycine apios L. Ground nut.
Strophostyles helvola (L.) Britton. Wild bean. Waterlily wharf; mat. fr.
Strophostyles umbellata (Muhlenberg) Britton. Weed in cornfield; pods dehisced.

FAMILY OXALIDACEÆ

Xanthoxalis corniculata (Linnæus) Small. Common near shore about middle of island; fls. to fr.

FAMILY BALSAMINACEÆ

Impatiens biflora Walter. Touch-me-not. A few seen; fls. to fr.

FAMILY RUTACEÆ

Zanthoxylum clava-herculis L. Prickly ash, Pillenterry; common; fr.

FAMILY EUPHORBIACEÆ

Acalypha virginica L. Mercury weed. Common; mat. fr.
Acalypha gracilens A. Gray. In old pine woods; mat. fr.
Chamæsyce preslii (Gussone) Arthur. Spurge. Occasional; mat. fr.

FAMILY ANACARDIACEÆ

Rhus copallina L. Dwarf sumach. Common; fr.
Toxicodendron radicans (L.) Kuntze. Poison Ivy, Shoe-string weed; common; fr.

FAMILY ILICACEÆ

Ilex opaca Aiton. Holly. Scattered in pine woods.
Ilex vomitoria Aiton. Youpon. Perhaps native as a few trees were found in a wet thicket, but most of the hollies of this species on the island were planted, the leaves being commonly used in making tea. Native on Knotts Id., and on the beach at least to the neighborhood of Princess Anne, Va.

FAMILY ACERACEÆ

Acer rubrum L. Red maple. Common.

FAMILY RHAMNACEÆ

Berchemia scandens (Hill) Trelease. Rattan vine. Common; fr.

FAMILY VITACEÆ

Vitis æstivalis Michaux. Summer Grape. Scarce; fr. Sept.
Vitis rotundifolia Michaux. Bullace grape. Common; fr. Sept.
Ampelopsis arborea (L.) Rusby. Peppervine. Common; fr.
Parthenocissus quinquefolia (L.) Planchon. Virginia Creeper. Common.

FAMILY MALVACEÆ

Abutilon abutilon (L.) Rusby. Butter-print. Common; fr.
Hibiscus militaris Cavanilles. Common in marsh; mat. fr.

FAMILY HYPERICACEÆ

Ascyrum hypericoides L. St. Andrews Cross. Pine woods; fr.
Hypericum perforatum L. mat. fr.
Hypericum mutilum L. Common in woods near marsh; fls. to mat. fr.

FAMILY VIOLACEÆ

Viola triloba Schweinitz. In old pine woods; mat. fr.
Viola septemloba Le Conte. In old pine woods; capsules empty.
Viola odorata L. Sweet Violet. Yard, spontaneous. Fls.

FAMILY PASSIFLORACEÆ

Passiflora incarnata I. Passion flower, May-pop; pop-apple; common; fls. and fr. in September; fr. only in October.
Passiflora lutea L. Common; twining in thickets; fr.

FAMILY CACTACEÆ

Opuntia pollardi Britton and Rose. Prickly Pear. A large colony on shore of Sound near old pine woods; fruit, Sept.-Oct.

FAMILY LYTHRACEÆ

Ammannia kœhnei Britton. Marsh; mat. fr.
Decodon verticillata (L.) Elliott. Immature to ripe fruit Sept., 1909; not seen in 1918.

FAMILY MELASTOMACEÆ

Rhexia mariana L. Pine woods; fr.

FAMILY ONAGRACEÆ

Oenothera biennis L. Evening Primrose. Common weed; fr.

FAMILY HALORAGIDACEÆ

Proserpinaca pectinata Lamarck. Mermaid weed. Common on mud along edge of marsh.

Myriophyllum sp. Common in ditches at South End.

FAMILY ARALIACEÆ

Aralia spinosa L. Hercules' Club. Scarce; wet thickets.

FAMILY AMMIACEÆ

Sanicula canadensis L. Snake root. Basal leaves in old pine woods.

Fœniculum fœniculum (L) Karsten. Fennel. A very common weed; fr. both September and October.

Hydrocotyle umbellata L. Marsh pennywort. Abundant, mudflats along edge of marsh. Fls. to mat. fr.

Hydrocotyle ranunculoides L. Common along paths, and edges of marsh; fr.

Centella asiatica (L.) Urban. Old pine woods; mat. fr.

Ptilimnium capillaceum (Michaux) Rafinesque. Scarce in marsh. Fls. to mat. fr.

Cicuta maculata L. Water hemlock. Common; fr.

FAMILY CORNACEÆ

Cornus asperifolia Michaux. Common; fr.

Nyssa sylvatica Marsh. Sour Gum. A few trees in wet woods; fr. Sept.-Oct.

FAMILY SAPOTACEÆ

Bumelia lycioides (L.) Persoon. Carolina Buckthorn. Common along high shore of Sound; fr.

FAMILY EBENACEÆ

Diospyros virginiana L. Persimmon. Common; here as elsewhere the fruit varies much in quality, that of some trees being excellent.

FAMILY OLEACEÆ

Fraxinus americana L. White ash. A few trees in springy place; leaflets broadly ovate, much shorter and broader than on white ash in the vicinity of Washington, D. C.

FAMILY LOGANIACEÆ

Gelsemium sempervirens (L.) Aiton. Yellow Jessamine. Common in old pine woods.

FAMILY GENTIANACEÆ

Sabbatia dodecandra (L.) Britton, Sterns and Poggenburg. Marsh pink. One very old and damaged specimen in edge of marsh.

FAMILY ASCLEPIADACEÆ

Asclepias rubra L. Scattered in distribution.

FAMILY CONVOLVULACEÆ

Ipomœa hederacea Jacquin. Morning Glory. Weed in gardens and fields; fls. to fr.

FAMILY CUSCUTACEÆ

Cuscuta sp. Dodder noted but not identified.

FAMILY BORAGINACEÆ

Heliotropium indicum L. Heliotrope. Waterlily Road. Fls. to mat. fr.

FAMILY VERBENACEÆ

Verbena urticifolia L. Occasional weed; fls. to mat. fr.
Lippia nodiflora (L.) Michaux. Flowers to ripe fruit, Sept.
Callicarpa americana L. French Mulberry. Of scattering distribution; a specimen of tree form 15 feet high, with the trunk 3 inches in diameter seen; fr. both September and October.

FAMILY LABIATÆ

Teucrium canadense L. Fls.
Marrubium vulgare L. Hoarhound. Common about houses. Fls. to mat. fr.
Nepeta cataria L. Catnip. Near Waterlily Wharf.
Prunella vulgaris L. Self-heal. Waterlily Road; fls. to fr.
Monarda punctata L. Horse mint. Common.
Lycopus virginicus L. Bugle-weed. Common along shore of Sound; mat. fr.
Mentha spicata L.. Spearmint. Fls. Sept., 1909.
Perilla frutescens (L.) Britton. Common; fr.

FAMILY SOLANACEÆ

Solanum nigrum L. Nightshade. Common; fr.
Solanum carolinense L. Horse nettle; Common; fr.
Datura stramonium L. Jimson Weed. Common; fr.

FAMILY SCROPHULARIACEÆ

Verbascum thapsus L. Mullen. Of scattering distribution; not common.
Agalinis purpurea (L.) Britton. Common; fls. to fr.

FAMILY BIGNONIACEÆ

Bignonia radicans L. Trumpet creeper. Common; fr.

FAMILY ACANTHACEÆ

Ruellia strepens L. Scarce. Flowers Sept.-Oct.

FAMILY PLANTAGINACEÆ

Plantago major L. Common Plantain. Common weed.
Plantago lanceolata L. Ribgrass. Common weed in gardens.

FAMILY RUBIACEÆ

Oldenlandia uniflora L. Scattered in distribution; mat. fr.
Mitchella repens L. Partridge Berry. In old pine woods; fr.
Diodia teres Walter. Button weed. Common weed. Mat. fr.
Diodia virginiana L. Flowers to mat. fruit Sept.
Galium pilosum Aiton. Shore near pine woods. Mat. fr.
Galium claytoni Michaux. Marsh.

FAMILY CAPRIFOLIACEÆ

Sambucus canadensis L. Elder. Common.

FAMILY CUCURBITACEÆ

Cucurbita moschata Duchesne. Squash. One plant near Waterlily Wharf; fl.
Cucumis melo L. Muskmelon. A few small plants in wet ground near marsh; fls.
Melothria pendula L. Creeping cucumber. Old pine woods; mat. fr.

FAMILY LOBELIACEÆ

Lobelia syphilitica L. Marsh; fr.
Lobelia amœna Michaux. Wet places; fls. to fr.
Lobelia elongata Small. Marsh. Fls. to fr.

FAMILY CICHORIACEÆ

Sonchus arvensis L. Sow thistle. A few rosettes of basal leaves near Waterlily Wharf.
Hieracium marianum Willdenow. Basal leaves common in and near old pine woods; one plant in flower and fruit.

FAMILY AMBROSIACEÆ

Iva frutescens L. Of scattering distribution.
Ambrosia elatior L. Ragweed. Abundant weed.
Xanthium americanum Walter. Cocklebur. Common weed. Mat. fr.

FAMILY COMPOSITÆ

Elephantopus carolinianus Willdenow. Common in woods bordering marsh, and along road.

Eupatorium capillifolium (Lamarck) Small. Abundant, here about equal in abundance to ragweed; in coastal states farther south it quite usurps the haunts and dominance among weeds of ragweed in the north.

Eupatorium serotinum Michaux. Waterlily Road and adjacent woods. Fls. to ripe akenes.

Eupatorium perfoliatum L. Boneset. Scarce.

Eupatorium cœlestinum L. Mist-flower. Common; fls. to fr.

Mikania scandens (L.) Willdenow. Common running over shrubs in wet places, also trailing on ground in old pine woods.

Solidago altissima L. Goldenrod. Common; fls. to fr.

Solidago serotina Aiton. Common; fls. to fr.

Euthamia minor (Michaux) Greene. Abundant; fls. to fr.

Euthamia graminifolia (L.) Nuttall. The broader leaved and less common kind. Waterlily Road. Fls.

Aster puniceus L. Common in marsh and swamp spots; fls. to fr.

Aster salicifolius Lamarck? Trailing form in old pine woods; fl.

Aster ericoides L. White Heath Aster. Omnipresent and very abundant.

Baccharis halimifolia L. Common.

Pluchea camphorata (L.) De Candolle. Pink-top Smartweed. Common; fls. to fr.

Anaphalis margaritacea (L.) Bentham and Hooker. Everlasting. Common.

Polymnia uvedalia L. Leaf-cup. Common in waste places; fls. to mat. fr.

Phæthusa occidentalis (L.) Britton. Common in waste places. Fls. to fr.

Coreopsis verticillata L. Common. Fls.

Bidens lævis (L.) Britton, Sterns and Poggenburg. Bur Marigold. Common in woods along edge of marsh. Fls. to fr.

Bidens bipinnata L. Spanish Needles. Common. Mat. fr.

Bidens trichosperma (Michaux) Britton. Common in marsh; fls. to mat. fr.

Erechtites hieracifolia (L.) Rafinesque. Scattered in all parts of island; mat. fr.

Cirsium lanceolatum (L.) Hill. Thistle. Fairly common; fls. to fr.

In connection with the above list it may be well to place on record the names of plants collected at other points in Currituck County.

POPLAR BRANCH, SEPT. 3, 1909

Decodon verticillatus. fls., imm. fr.; Jussiæa decurrens. fls., imm. fr.

NARROWS ID., SEPT. 3, 1909

Potamogeton pectinatus, Ruppia maritima, Naias flexilis, Vallisneria spiralis, Sagittaria lancifolia. fls. imm. fr.; Asclepias pulchra. fls.

CURRITUCK CLUB, SEPT. 3, 1909

Typha angustifolia, Potamogeton perfoliatus, Potamogeton pectinatus, Ruppia maritima, Naias flexilis, Philotria canadensis, Vallisneria spiralis, Echinochloa crusgalli longearistata, mat. fr.; Spartina polystachya, Cyperus microdontus, Cyperus rotundus, Cyperus erythrorhizos, Fimbristylis castanea, mat. fr.; Scirpus robustus, mat. fr.; Juncus scirpoides, Rumex verticillatus, Persicaria punctata, Acnida cannabina, Portulaca oleracea; mat. fr.; Ceratophyllum demersum, Kosteletzkya virginica, fls.; Hydrocotyle umbellata, Ptilimnium capillaceum, imm. fr.; Lobelia glandulosa, fls.; Mikania scandens, mat. fr.; Pluchea camphorata, fls.

CURRITUCK INLET, SEPT. 4, 1909

Cyperus flavescens, Scirpus debilis, mat. fr., Juncus megacephalus, Salsola kali, mat. fr.; Sabbatia angustifolia, fls.; Physalis viscosa, fls. imm. fr.; Pluchea camphorata, fls.

WASHINGTON, D. C.

THE DISTRIBUTION OF RHODODENDRON CATAWBIENSE, WITH REMARKS ON A NEW FORM.

By W. C. Coker

Plates 19, 20, 21 and 22.

Rhododendron catawbiense was discovered by John Fraser, the indefatigable English explorer, on the top of Roan Mountain in 1799. Sent to England by him it was there greatly admired and soon established itself as one of the most popular of cultivated plants. It has been much hybridized by skillful breeders and its blood is now to be distinguished in many of the splendid hybrid Rhododendrons so extensively used today.

The actual distribution of the species and its forms is one of the most remarkable and puzzling of which we have record, and not less remarkable is the ignorance among botanists of the extent of this distribution. The manuals covering this territory confine the species to the mountains. Gray's Manual, Seventh Edition, says "High Alleghanies, Va., to Ga;" Small's Flora of the Southeastern United States says "On mountain slopes Virginia to West Virginia, Georgia and Alabama." Dr. M. A. Curtis in his Catalogue of North Carolina Woody Plants makes the inexplicable mistake of considering the Orange County plant as *R. maximum,* although it existed in quantity on the hills directly across the river from his home at Hillsboro. He says of *R. maximum* that it grows as "far east as Orange," while of *R. catawbiense* he says, "It is often confounded with the preceding [*R. maximum*], but besides its different locality, growing only on the tops of such mountains as the Roan in Yancey and Negro Mountain in Ashe, it blossoms earlier than the other, though at a higher elevation, has larger and more intensely colored flowers, and shorter and broader leaves."

The only published records that I have been able to find of the occurrence of *R. catawbiense* elsewhere in North Carolina than on the tops of the high mountains are by Dr. Asa Gray, Prof. F. W. Simmons, and by Dr. John K. Small. Dr. Gray was sent specimens in flower by Prof. Simmons from Chapel Hill and in

RHODODENDRON CATAWBIENSE FORM INSULARIS
From Chapel Hill, May 12, 1914
Reduced

his *Notes of a Botanical Excursion into North Carolina,* says in a footnote: "Our own observations would restrict *Rhododendron Catawbiense* to the tops of the higher mountains, or to some such peculiar station as this at Linville Falls at somewhat lower elevations. But Mr. Howard Shriver pointed out to me a locality at the foot of the low mountains which rise behind Wytheville in Virginia; and, what is truly extraordinary, Prof. F. W. Symonds, of the University of North Carolina, sends specimens, in full bloom on the third of April, on a steep and shaded bank on Morgan's Creek, near Chapel Hill, in the middle upper country of the State, flourishing at an elevation of only 500 feet above the level of the sea!" (Bull. T. B. Club **6**: 336. 1879). A little later in the same year Professor Simmons published a note *On the Habitat of Rhododendron catawbiense,* in which he records its occurrence at Chapel Hill (Am. Naturalist, Dec. 1879, p. 777). He quotes from Dr. Gray's letter to him on receipt of specimens, as follows: "The laurel (which I had heard of from one of your pupils whom I met in June) I am delighted to see. It is certainly, as you say, *R. catawbiense,* and most remarkable for occurring at so low a level, where it flowers early. It comes down somewhat as *R. punctatum* does in Georgia. But this is *more remarkable.*" These early records seem to have been entirely forgotten, for they have never found their way even into Gray's own Manual. More recently Dr. Small has collected *R. catawbiense* on Kings Mountain, one of the points we visited (Torreya **1**: 7. 1901).

At Chapel Hill, at Hillsboro, at Patterson's Mill in Orange County, and about eight miles north of Durham, at Christian's Mill near the Roxboro road in Durham County this Rhododendron grows in flourishing abundance on the steep, northward-facing banks and bluffs of Morgan's Creek, New Hope Creek, and Eno River.

Surprising as these occurrences may seem we can now report still more remarkable extensions of the range. In 1908 I secured specimens of *R. catawbiense* in bloom that were collected by Mr. W. J. Andrews of Raleigh from his farm, one mile west of Cary. It grew in plenty on the south bluff of Crabtree Creek. A little later I heard rumors of the occurrence of Rhododendron at Selma, and made a

trip there to locate it. Driving out to the banks of the Neuse River about 4 miles north of town I found *Rhododendron catawbiense* in full bloom, and quite abundant on a steep bluff on the south side of the river, a position exactly similar to its station in Chapel Hill. This record extends the species to the middle of the coastal plain and down to an elevation of about 150 feet above the sea.

There seems to be no published record of the occurrence of this species between the tops of the high mountains of the main ranges and Orange County except from Kings Mountain, as mentioned above, and from Table Rock by Nuttall (Genera of N. Am. Plants **2**: 5. 1818) who records it from the "romantic summit" in company with his interesting *Hudsonic montana*, which seems to be confined to this place. To these records we can now add Crowders Mountain, near Kings Mountain, these two being abrupt eminences in Gaston County near the South Carolina line and about sixty miles from the nearest high mountains. Dr. Small visited Table Rock July 2, 1891, but failed to notice *R. catawbiense* there (Mem. Tor. Bot. Club **3**: 10. 1892). It is also very strange that Dr. Asa Gray and his large party who ascended Table Rock on June 12, 1879, failed to recognize this species (Bull. Tor. Bot. Club **6**: 335. 1879). The plants had flowered about a month before their arrival and they must have carelessly taken it for *R. punctatum* or *R. maximum*. They report only the former. It is interesting to note that they found on the same trip that *R. catawbiense* was just coming into bloom on Roan Mountain on June 16th.

In May of this year the writer with three of his students took an automobile trip to the three mountains just mentioned to ascertain what species of Rhododendron grew on them and to look for Rhododendron in other places. Rehder has reported (from Small's collections) *R. carolinianum* and *R. minus* from *Table Rock* (Rhodora **14**: 97. 1912). We found the former in abundance and in full bloom, but did not see the latter. There was also an abundance of *R. catawbiense* in bloom on the top (elevation about 3,900 feet) and on the sides in small amount down to perhaps 2,500 feet. Near the top but not on it a few clumps of *R. maximum* were seen.

PLATE 20

DENDRIUM PROSTRATUM (above)
RHODODENDRON CATAWBIENSE (below)
Both from top of Table Rock, May 18, 1919

PLATE 21

TABLE ROCK (above)
KINGS MOUNTAIN (middle)
CROWDERS MOUNTAIN (below)

Leaving Table Rock we went south to Lincolnton where we were told that Rhododendron grew on the Little Catawba. It proved, as is so often the case, to be only Kalmia. Continuing south to near the South Carolina line we ascended Kings Mountain (950 feet) and Crowders Mountain (1,600 feet). On the first was a fine display of *R. catawbiense* in full bloom in crevices, ledges and gorges along the precipitous faces. It was interesting to find that there was associated with Rhododendron here *Pachythergilla major,* as is also the case in Chapel Hill. The conditions on Crowders Mountain were about the same. There was only a very little *R. catawbiense* on the northern peak, but more on the higher central peak. No other species of Rhododendron was seen on either mountain.

From reliable observers (Mrs. Harper and Miss Goforth) we find that *R. catawbiense* grows about three to four miles west of Lenoir on a small elevation called Peaky Top and on hills around Harper Town, about two miles west of Lenoir. There are also said to be scattered patches in the valley between Black Mountain and Montreat (elevation of about 2,100 feet), and Mr. F. M. Crayton, formerly of the Biltmore Nursery, has told me that it occurs at the foot of Craggy Mountain on the east side and down the east side of a number of other mountains to an altitude less than two thousand feet. It would seem that this species descends to about 2,000 feet down the eastward slopes of the Blue Ridge and Alleghenies, but that it does not descend down the western slopes.

Notwithstanding the extension of the range of this species in the mountain region down to Table Rock and Kings and Crowders Mountains we still have remaining the very remarkable fact that in the center of the State is a group of stations separated from the nearest ones to the westward by about 140 to 210 miles. The question naturally arises: Is the plant of the central region the same as the mountain one or is it a variety of it, or a different species? For several years I have been trying to get the mountain form to bloom in Chapel Hill to compare side by side with the Chapel Hill form, and this spring was successful. Flowers of the mountain form (obtained from Highlands Nursery) were like ours except that they were broader in proportion to width than most of ours. The flowers of the Chapel Hill

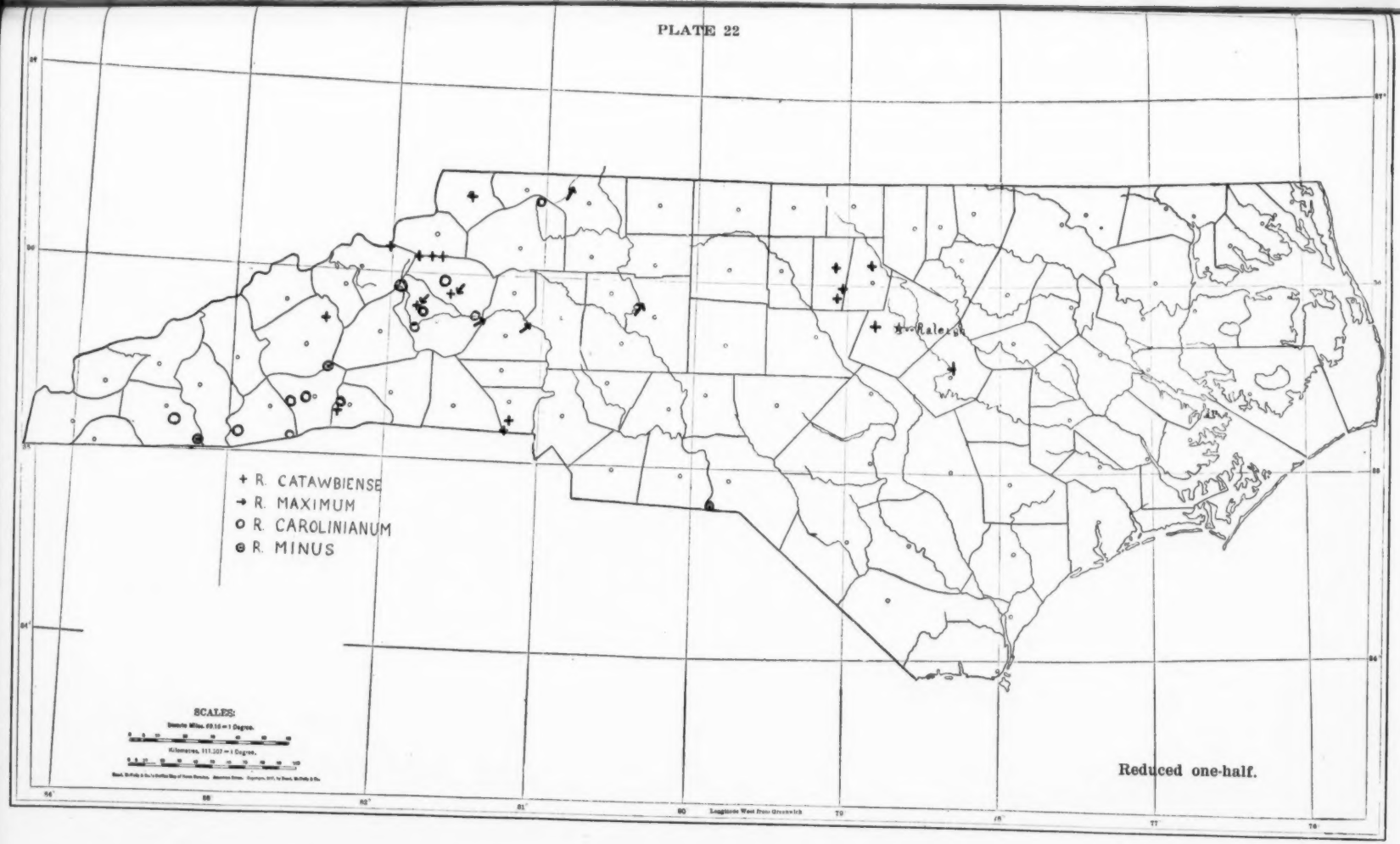
plants averaged 1.1 times broader than long, while the flowers of the nursery plant were 1.4 times broader than long. The flowers of the Table Rock plant were not to be distinguished from the nursery plant, being open and broad, but the two Crowders Mountain plants found in bloom had longer flowers like the Chapel Hill ones and were almost exactly as long as broad, and Kings Mountain plants were about the same. However, there is variation in the Chapel Hill form in all points, and we found one plant here with very large fine flowers with crimped margin in which the flowers were 5.7 cm. long by 8 cm. broad or 1.4 times broader than long, as in the mountain form.

As to the leaves, our local plants have leaves that average larger and broader in proportion than the mountain ones. In herbarium specimens from Caldwell and Mitchell Counties the leaves average 3.8 x 9.1 cm. or 2.4 times longer than broad. In the Chapel Hill plants they average about 5.7-6 x 11 cm., or only 1.9 times longer than broad. On one branch of a plant with very large leaves all the leaves averaged 1.6 times longer than broad, the longest leaf being 8.4 x 14.8 cm. Leaves from collections made on our recent trip run as follows:

Crowders Mountain plant: leaves 1.8-2.1 times longer than broad.
Crowders Mountain plant: leaves 1.5-2 times longer than broad.
Kings Mountain plant: leaves 2.1-2.7 times longer than broad.
Kings Mountain plant: leaves 2.1-2.2 times longer than broad.
Kings Mountain plant: leaves 2-2.1 times longer than broad.
Kings Mountain plant: leaves 2-2.5 times longer than broad.
Kings Mountain plant: leaves 2.3-2.7 times longer than broad.
Table Rock plant: leaves 1.9-2 times longer than broad.
Table Rock plant: leaves 2-2.5 times longer than broad.

The greenish dots in the flower throats vary in the Chapel Hill plant from quite conspicuous to almost invisible. In flower color, in habit, in pubescence of pod and young parts no differences of consequence appear in the plants from different places. It would seem then that while no constant difference appears between the plants from various localities the mid-State form has flowers that average longer in proportion and leaves that average broader in proportion

PLATE 22



Reduced one-half.

and larger than the high mountain form. I therefore think it best to give the mid-State plant a form name and propose to call it.

Rhododendron catawbiense f. INSULARIS n. forma.
Differs from the type in the larger and broader leaves and in the longer flowers. NORTH CAROLINA: On precipitous bluffs by streams, lower Piedmont and Coastal Plain.

As the streams along which our form grows are not connected in any way with the territory occupied by the type, and as the respective areas are so widely separated, it is highly probable that there has been no intermixture for a good many thousand years. This territorial segregation would in itself almost justify the separation of the forms even though little or no structural distinction were obvious, and it would perhaps be justifiable to give the Kings and Crowders Mountain form a distinctive name also. It is probable that at all these widely separated stations the plants are a little different, though the differences are hard to distinguish.

In our map of distribution (Pl. 22) we have given only a few scattered locations in the high mountains, but have indicated all that we know of with certainty at altitudes of less than 2,500 feet. The species is also found on Lookout Mountain, Tennessee, and as far south as Albertville, Marshall County, Alabama (Harbison).

It may be well to add a word as to the eastward extension of *R. maximum*. It extends to about Hickory in the center and has been reported as extending into Surry and Gaston Counties on the north and south (Pinchot and Ashe, N. C. Geol. Survey Bull. **6**: 68. 1897). As Surry reaches the mountains we would expect it in abundance there, but its occurrence in Gaston seemed so improbable that I wrote Mr. Ashe for confirmation, and he replied that he thinks this record a mistake due to confusion with *R. catawbiense*. We can now report it about sixty miles farther east at Yadkin College on the Yadkin River, Davidson County. We have also found it about one mile below Buffalo Shoals Bridge on the Catawba (Statesville-Hickory road).

The species is, of course, abundant down the eastern slopes of the mountains and on the nearby hills as far as Lenoir and Hickory, while *R. catawbiense*, while scarce and scattered, continues its descent eastward to far lower altitudes.

We have also indicated on the map such stations for *R. carolinianum* and *R. minus* as we have good evidence to include. So far as *R. carolinianum* is concerned, these few stations are certainly nothing more than indications of an extensive distribution within the regions they occupy. *Rhododendron minus* is not yet well worked out and three of the stations we give (Highlands, Macon Co.; Whiteside Mountain, Macon Co.; and Hickory Nut Gap, Brunswick Co.) are on the authority of Mr. T. G. Harbison, who collected it in these places for the Biltmore Nursery. At Hickory Nut Gap he found not only the magenta, but also a white-flowered form. The fourth North Carolina station shown on the map is in Richmond County almost on the South Carolina line on Mark's Creek near its entrance into the Pee Dee river about eight miles from Kollock, S. C., on the plantation of Mr. Frank B. Pegues. It also grows just across the line in South Carolina on the same plantation. Mr. Harbison has also found the species at Stumphouse Mountain, Oconee County, S. C.

CHAPEL HILL, N. C.

and larger than the high mountain form. I therefore think it best to give the mid-State plant a form name and propose to call it.

***Rhododendron catawbiense* f. INSULARIS n. forma.**

Differs from the type in the larger and broader leaves and in the longer flowers. NORTH CAROLINA: On precipitous bluffs by streams, lower Piedmont and Coastal Plain.

As the streams along which our form grows are not connected in any way with the territory occupied by the type, and as the respective areas are so widely separated, it is highly probable that there has been no intermixture for a good many thousand years. This territorial segregation would in itself almost justify the separation of the forms even though little or no structural distinction were obvious, and it would perhaps be justifiable to give the Kings and Crowders Mountain form a distinctive name also. It is probable that at all these widely separated stations the plants are a little different, though the differences are hard to distinguish.

In our map of distribution (Pl. 22) we have given only a few scattered locations in the high mountains, but have indicated all that we know of with certainty at altitudes of less than 2,500 feet. The species is also found on Lookout Mountain, Tennessee, and as far south as Albertville, Marshall County, Alabama (Harbison).

It may be well to add a word as to the eastward extension of *R. maximum*. It extends to about Hickory in the center and has been reported as extending into Surry and Gaston Counties on the north and south (Pinchot and Ashe, N. C. Geol. Survey Bull. **6**: 68. 1897). As Surry reaches the mountains we would expect it in abundance there, but its occurrence in Gaston seemed so improbable that I wrote Mr. Ashe for confirmation, and he replied that he thinks this record a mistake due to confusion with *R. catawbiense*. We can now report it about sixty miles farther east at Yadkin College on the Yadkin River, Davidson County. We have also found it about one mile below Buffalo Shoals Bridge on the Catawba (Statesville-Hickory road).

The species is, of course, abundant down the eastern slopes of the mountains and on the nearby hills as far as Lenoir and Hickory, while *R. catawbiense*, while scarce and scattered, continues its descent eastward to far lower altitudes.

We have also indicated on the map such stations for *R. carolinianum* and *R. minus* as we have good evidence to include. So far as *R. carolinianum* is concerned, these few stations are certainly nothing more than indications of an extensive distribution within the regions they occupy. *Rhododendron minus* is not yet well worked out and three of the stations we give (Highlands, Macon Co.; Whiteside Mountain, Macon Co.; and Hickory Nut Gap, Brunswick Co.) are on the authority of Mr. T. G. Harbison, who collected it in these places for the Biltmore Nursery. At Hickory Nut Gap he found not only the magenta, but also a white-flowered form. The fourth North Carolina station shown on the map is in Richmond County almost on the South Carolina line on Mark's Creek near its entrance into the Pee Dee river about eight miles from Kollock, S. C., on the plantation of Mr. Frank B. Pegues. It also grows just across the line in South Carolina on the same plantation. Mr. Harbison has also found the species at Stumphouse Mountain, Oconee County, S. C.

CHAPEL HILL, N. C.